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TEST PROCEDURE REVISION FOR RETRO-REFLECTANCE MEASUREMENTS.(U)
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TEST PROCEDURE REVISION FOR RETROREFLECTANCE MEASUREMENTS

August 1976

U.S. ARMY MOBILITY EQUIPMENT
RESEARCH AND DEVELOPMENT COMMAND
FORT BELVOIR, VIRGINIA

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A test method for measuring the retroreflectance property of samples in a laboratory room, using mirrors to fold the beam.

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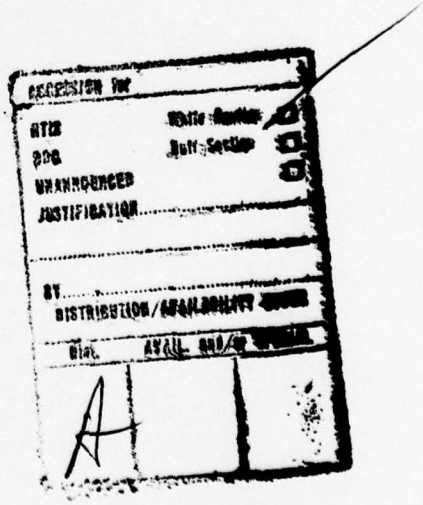
PREFACE

This work was performed by Edwin A. Heck with guidance from Robert C. McMillan, Chief, Radiation Research Group, Material Technology Laboratory, US Army Mobility Equipment Research and Development Command, Fort Belvoir, Virginia 22060. The test distance of 28.65 feet used in the work was taken from a document authored by Mr. George Watton, GSA, Seattle, Washington.



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TEST PROCEDURE FOR RETROREFLECTANCE MEASUREMENTS

I. INTRODUCTION

1. **Purpose.** The intended purpose of this report is to:

a. Present a nonpermanent retroreflectance test system capable of performing in a standard, darkened laboratory room.

b. Discuss the system's sensitivity and reproducibility.

c. Discuss the test method in regard to appropriate revision of specifications.

2. **Scope.** The data were obtained with various combinations of:

a. Sixteen retroreflectance panels.
b. One white painted reference panel.
c. Twelve incident angles.
d. Five divergent angles.
e. Three sample-to-receptor (S-R) distances.

The raw data of each combination were computer processed to provide output data relative to the white reflectance standard, barium sulphate ($BaSO_4$). These resultant data were combined appropriately and computer processed to analyze the combinations of variables of the nonfolded measurements to the folded measurements and folded-to-folded measurements, with other variables constant.

3. **Background.** Certain signs, markers, highway and airfield runway markings, etc., have a specific reflective property built into the item. This property, termed "retroreflectance," reflects the source beam back toward the source with some varying amount of dispersion but with a higher intensity in particular areas than does a diffuse reflecting surface.

Test methods and specifications TT-P-87, "Paint; Traffic, Premixed Reflectorized," L-S-300, "Sheeting and Tape, Reflective; Nonexposed Lens, Adhesive Backing," TT-C-001060, "Coating Compound, Reflective," and MIL-S-2580, "Sign Boards, Blank (For Temporary Outdoor Signs)," require the sample-to-receptor distances of up to 50 feet. These extreme test distances are not readily available.

This report covers:

a. Measuring the retroreflectance of the samples in the normal method.
b. Measuring the retroreflectance of the samples with the light beam folded.
c. Results.
d. Analyses of the data.
e. Discussion.

II. INVESTIGATION

4. Approach to the Problem. Current retroreflectance test methods require test distances in excess of the dimensions of a normal laboratory room. A method of folding the optical path was devised and is presented here. The system was constructed and test data were obtained. The data consist of the results of combining a series of 16 samples, 3 sample-to-receptor distances, 12 incident angles, and 4 divergent angles during the folded and nonfolded retroreflectance measurements. These results are evaluated and show that the folded system can be used effectively, provided adequate controls for the mounting of the retroreflectance equipment are established.

5. Samples. The retroreflective samples consisted of eleven colored "flat top" panels (i.e., a smooth plastic surface over the beads) and five panels with exposed beaded surfaces. All the samples were on aluminum panels.

A panel painted with a white diffuse reflecting paint (reference panel) was measured with each set. The diffuse spectrophotometric reflectance, as determined on a General Electric recording spectrophotometer, was 90.9 percent relative to a calibrated barium sulphate standard. The samples were labelled as in Table 1.

6. Equipment. The following items were used:

a. The light detection system was a Pritchard "Spectra" Model 1980 photometer. This instrument is equipped with a photopic correction filter (see Table 2), neutral density filters, and apertures. The total accuracy is ±4 percent or ±2 units of full scale, whichever is larger. The photometer was also equipped with an automatic compensation system so that as the apertures, the neutral density filters, or the ranges were changed, the readings remained relative.

b. The light source was a Bell & Howell (B&H) 16-mm sound projector with the film transport and sound device removed. The 750-watt lamp was operated at a color temperature of approximately 2854 K, as determined with a Gamma Scientific (GS) Model 3000 recording spectroradiometer and a GS Model 220 standard lamp source. The spectral distribution of the source with a color temperature of 2854 K was measured and recorded. The 750-watt projection lamp voltage was adjusted and the spectral illuminance measured until the curve approximated the curve of the source

Table 1. Sample Labels

Sample No.	Identification	Area (ft^2)
1	W/BD	0.9948
2	W/FT	0.8485
3	W/FT	0.547
4	S/FT	0.547
5	OFW/FT	0.521
6	B/FT	0.547
7	GR/FT	0.547
8	GO/FT	0.547
9	Y/FT	0.547
10	O/FT	0.521
11	OR/FT	0.547
12	DR/FT	0.521
13	Y/Bd	0.9841
14	Y/Bd	0.9581
15	O/Bd	0.780
16	3M R-R Panel	1.0

NOTE: The sample identification coding is as follows:

(1) Letters before the slash: W–white, S–silver, OFW–off-white, *B*–blue, *GR*-green, *GO*–gold, *Y*–yellow, O–orange, OR–orange-red, DR–dark red.

(2) Letters after the slash: "Bd"–beaded, "FT"–flat-top.

(3) The "3M R-R panel" is a 3M Company material on a 12-inch aluminum panel.

lamp which had been measured previously (Figure 1).

c. First surface mirrors (10- by 14-inch, 16- by 16-inch, and 20- by 24-inch) were used to fold the light beam.

d. Tripods and fabricated mirror holders were used to hold and support the mirrors so adjustments could be obtained in all axes.

e. The sample holder was one that had been designed and fabricated previously for prior retroreflectance measurements. It had a protractor for sample alignment, was selsyn-operated, and used a long cable for the remote operation.

f. Two small first-surface mirrors were cemented to the sample holder at the center of rotation and at an angle of approximately 45 degrees to the 90° position of the sample. These mirrors reflected small spots of light onto the wall or incident angle index panel (later called "index panel") to assist in adjusting the incident angles.

g. The index panel was used to mark the 88- to 70-degree incident angles.

Table 2. Spectral Response Calibration
Photopic ($\bar{y}$) Filter
Serial No. 168 Date 2-5-73

Wavelength (nm)	True $\bar{y}$ (%)	Measured $\bar{y}$ (%)
380	0.00	*
390	0.01	*
400	0.04	0
410	0.12	0.3
420	0.40	0.6
430	1.16	1.2
440	2.30	2.1
450	3.80	3.6
460	6.00	5.5
470	9.10	9.4
480	13.90	15.5
490	20.80	26.3
500	32.30	40.0
510	50.30	57.0
520	71.00	71.4
530	86.20	87.0
540	95.40	97.0
550	99.50	100.0
560	99.50	99.2
570	95.20	95.2
580	87.00	88.1
590	75.70	77.0
600	63.10	57.7
610	50.30	38.3
620	38.10	25.2
630	26.50	17.3
640	17.50	12.3
650	10.70	8.5
660	6.10	5.8
670	3.20	3.8
680	1.70	2.6
690	0.82	1.7
700	0.41	1.1
710	0.21	0.7
720	0.10	0.5
730	0.05	0.3
740	0.02	0.2
750	0.01	0.1

* Measurements started at 400 nm

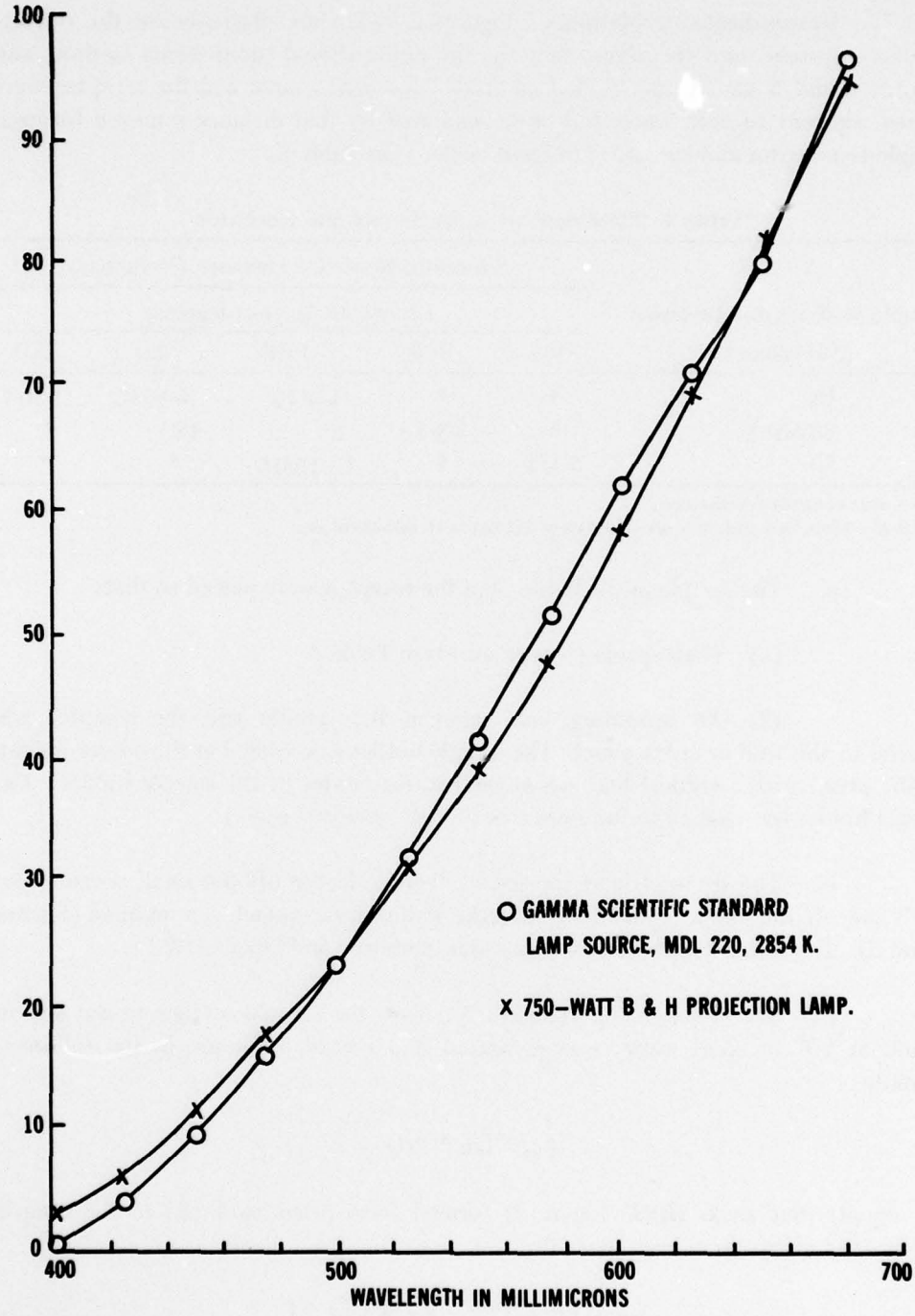

Figure 1. Color temperature: 750-watt B&H lamp vs. GS 2854 K standard lamp.

7. **Retroreflectance Methods.** Figures 2 and 3 are diagrams for the retroreflectance system used to obtain data for the conventional (nonfolded) method, and Figures 4 and 5 are for the folded method. The light source and the receptor were placed adjacent to each other but were separated by that distance required for each sample-to-receptor and for each divergent angle, as in Table 3.

Table 3. Placement of Light Source and Receptor

Sample-to-Receptor Distance (S-R) (feet)	Source-to-Receptor Distance (in Inches) Divergent Angles (degrees)				
	0.5	0.7	1.33	2.0	5.0
15	*	*	4-3/16	6-9/32	15-3/4
28.65**	*	4-3/16	8	12	*
50	5-1/4	*	13-15/16	*	*

* Not within bounds of equipment

** At 28.65 feet, each inch of source-to-receptor distance is 10 minutes of arc.

a. The sample in the holder and the receptor were placed so that:

(1) Their spacing was as shown in Table 3.

(2) An imaginary line between the sample and the receptor was parallel to the wall or index panel. The sample holder was leveled at the source height. A 45° prism with a vertical line was aligned in the center of the sample holder. The sample holder was aligned to the source beam (90° incident angle).

b. The spots of light formed by light reflected off the small mirror (spot "T") and off the prism (spot "R") onto the wall or index panel were marked (Figures 4 and 5). The distance between the spots was measured and labelled "P."

c. The distance "Q" (Figure 3), from the sample surface to the wall or panel, at 90° incident angle, was measured and recorded for use in the following formula:

$$\theta_{90} = \tan^{-1} P/Q$$

θ_{90} equals that angle (RST, Figure 3) formed from prism spot (R) to the sample holder (S) then to the mirror spot (T).

$$X = Q \tan [2(90° - \theta - .5\theta_{90})] + P$$

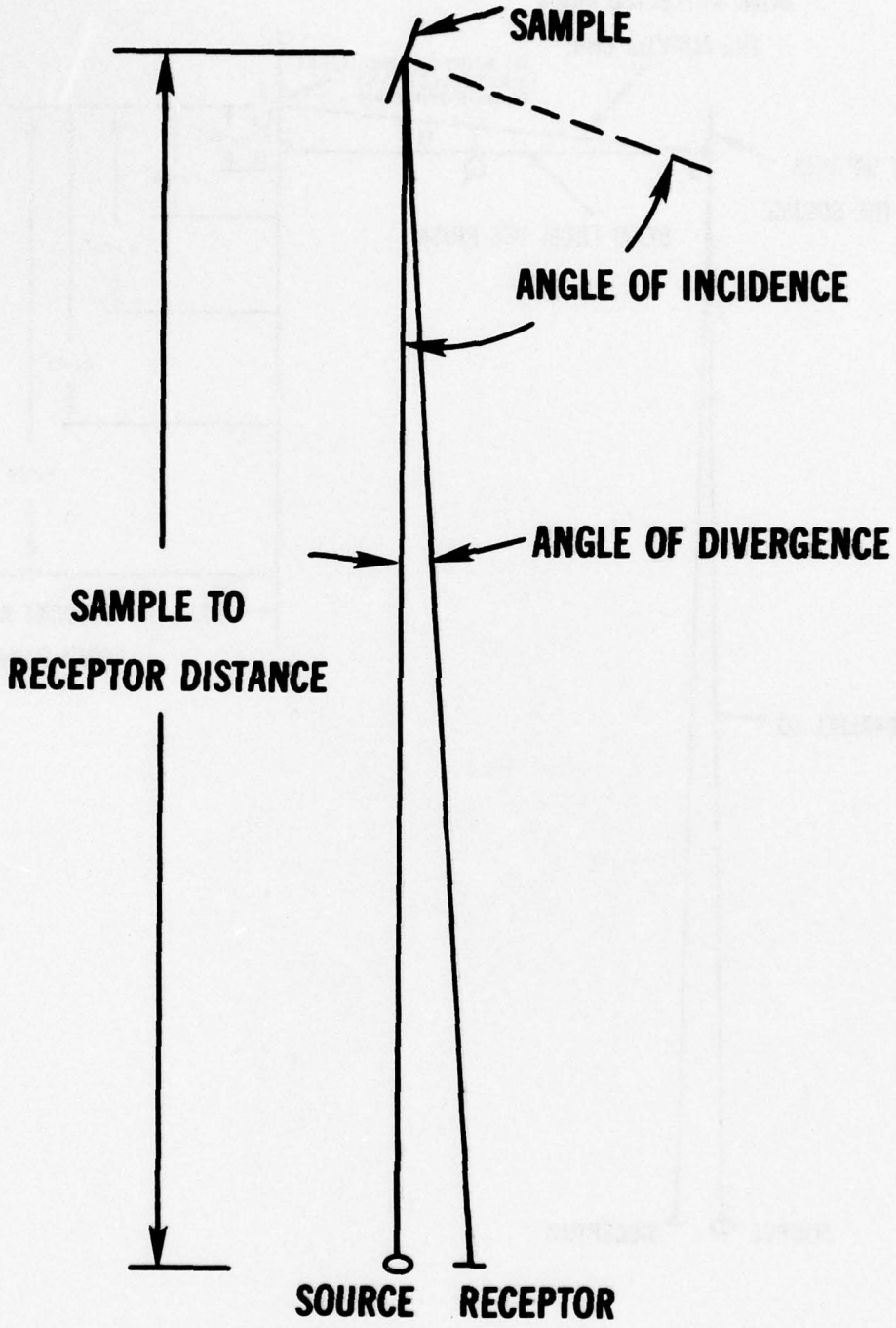

Figure 2. Conventional method.

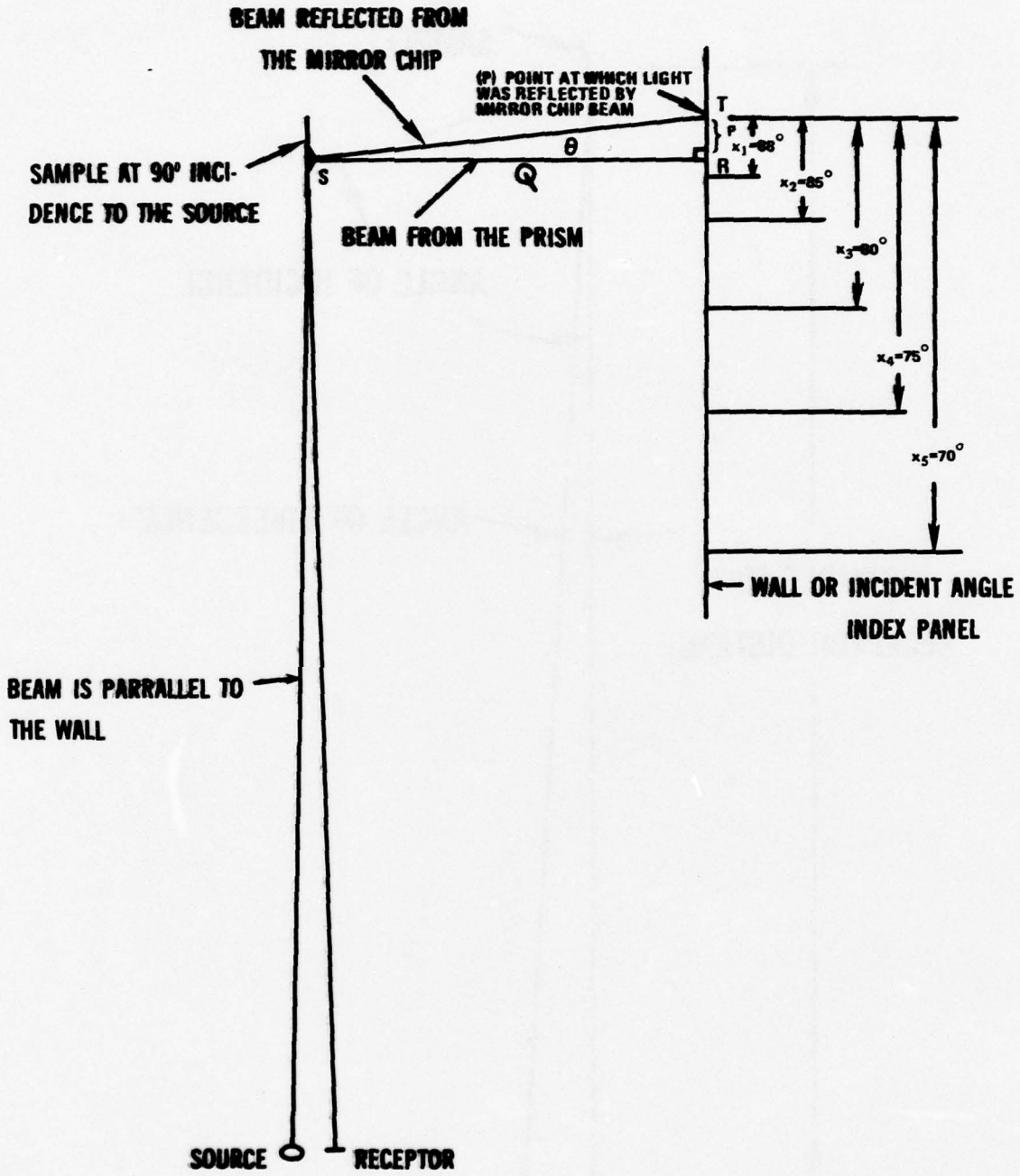

Figure 3. Conventional (not folded) system.

where: X = distance from the spot reflected by the mirror at T (see Figure 3) to each incident angle of θ (88, 85, 80, 75, and 70 degrees).

d. The single-folded-beam method was used for distances of 15 and 28.65 feet (Figure 4). The double-folded-beam method was used for the 50-foot distance (Figure 5).

e. The folded-beam systems required that:

(1) The source be levelled.

(2) The mirrors be placed correctly and the height adjusted, plumbed, and angled correctly.

(3) The sample holder be located the correct distance from the receptor and be plumbed, levelled, and height-adjusted.

(4) The incident angle index panel be placed parallel to the light beam that falls on the sample and the height adjusted so the light spot impinges on the index panel for all the incident angles.

8. **Alignment of the System.** The system was aligned as follows:

a. The components of the system were placed in their respective positions.

b. The source was turned on and angled to project the beam onto the sample.

c. The mirrors, sample holder, and source were moved and/or adjusted until:

(1) The source-to-receptor distance was correct.
(2) The sample-to-receptor distance was correct.
(3) The index panel was in the correct position.
(4) The light beam was on the sample, and the receptor was viewing the sample.

d. The index panel was aligned parallel to the light beam of the last mirror to the sample. A cord was aligned centrally with the light beam and attached from the last mirror to the sample holder to facilitate alignment of the index panel parallel to the light beam. During this alignment, the spot of light from the mirror on the sample holder must remain on the index panel for all of the 70 to 88 degree angles.

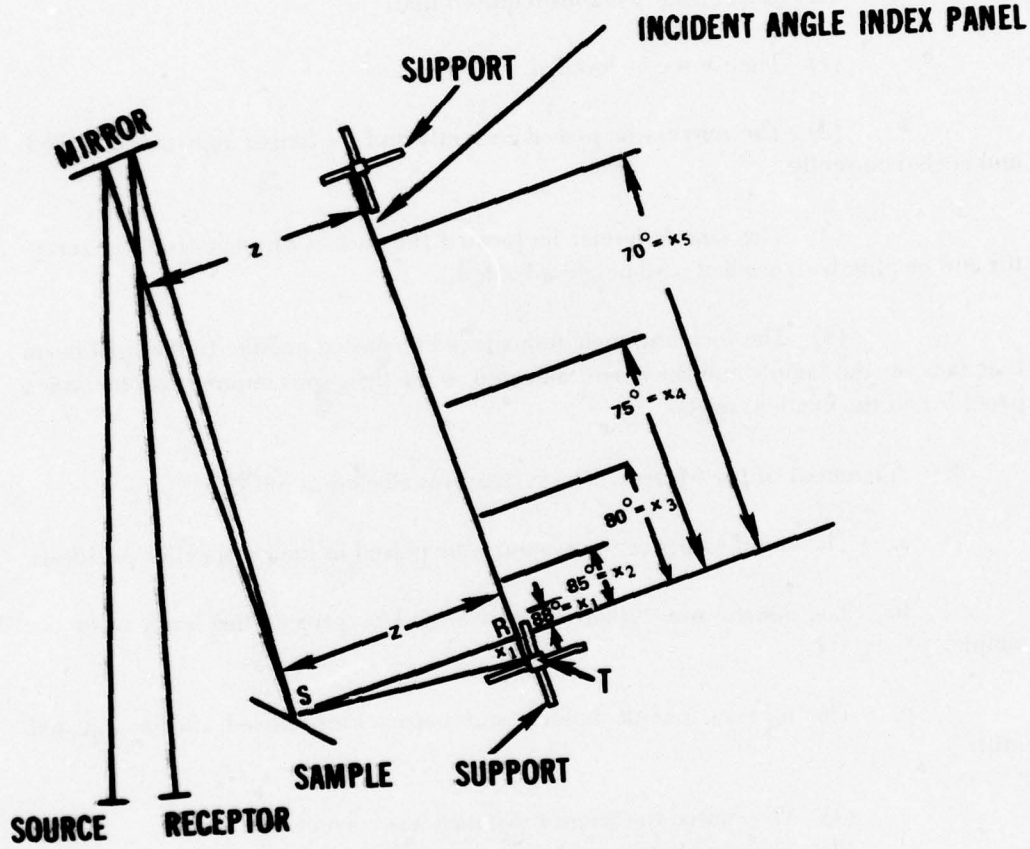

Figure 4. Single-folded system.

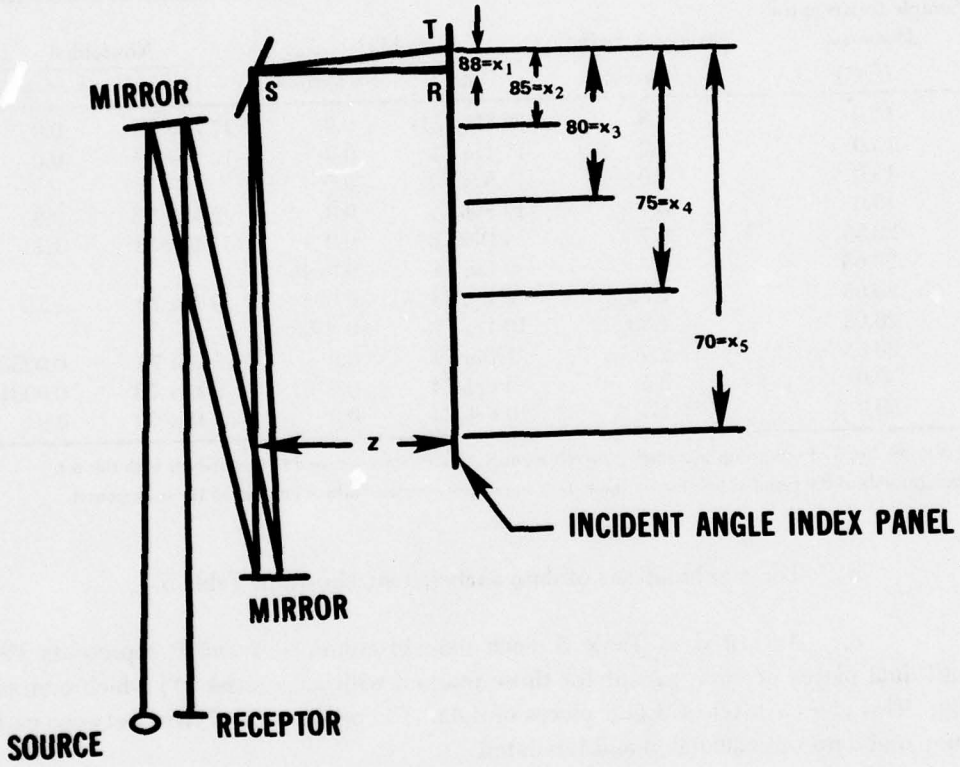

Figure 5. Double-folded system.

III. RESULTS

9. Data Results. The following data were obtained:

a. The data of eleven folded-beam methods and eight nonfolded methods are shown in Table 4.

Table 4. Test Data Obtained

Sample-to-Receptor Distances (feet)	Divergent Angles (degrees)	Folded		Nonfolded	
		Date	Background	Date	Background
15.0	1.33	26 May 73	0.0	17 Apr 73	0.0
15.0	2.0	17 Jan 74	0.0	18 Apr 73	0.0
15.0	2.0	Apr 73	0.0		
15.0	5.0	19 Feb 74	0.0	2 May 73	0.0
28.65	0.7	4 Dec 73*	0.0	31 Mar 73	1.1
28.65	0.7	9 Jan 74	0.0646		
28.65	1.33	6 Jun 73	0.034	3 Apr 73	1.28
28.65	1.33	10 Jan 74	0.0503		
28.65	2.0	1 Jun 73	0.0	15 Apr 73	0.0253
50.0	0.5	6 Feb 74	0.0161	6 May 73	0.0081
50.0	1.3	10 Feb 74	0.0	5 May 73	0.0

* Sample No. 5 of this group was absent; therefore, only 15 samples were used in the analysis with this set. Backgrounds of 0.0 resulted because on these data, apertures were used which eliminated the background.

b. The combinations of data analyzed are shown in Table 5.

c. As noted in Table 5, each date in columns A and B represents 192 individual pieces of data, except for those marked with an asterisk (*) which contain 180. This gives a total of 5,688 pieces of data. The percentage of error between each compared data was calculated and tabulated.

d. In Tables 6 through 20 (Data Sheets), the Brightness Ratios are values computed from test data and reflect ratios of the samples to barium sulphate ($BaSO_4$) Standard;

$$\text{Brightness Ratio} = \frac{\left(\frac{\text{Sample Reading}}{\text{Sample Area, ft}^2}\right) - \text{Background}}{\frac{\text{Paint Standard Reading - Background}}{\text{Paint Standard Reflectance (.909)}}}$$

Table 5. Combinations of Test Data

Test Distance (feet)	Divergent Angle (degrees)	Data A	Data B
15.0	1.33	26 May 73	17 Apr 73
15.0	2.0	17 Jan 74	18 Apr 73
15.0	2.0	Apr 73	17 Jan 74
15.0	2.0	Apr 73	18 Apr 73
15.0	5.0	19 Feb 74	2 May 73
28.65	0.7	4 Dec 73*	31 Mar 73*
28.65	0.7	4 Dec 73*	9 Jan 74*
28.65	0.7	9 Jan 74	31 Mar 73
28.65	0.7	9 Jan 74*	31 Mar 73*
28.65	1.33	6 Jun 73	3 Apr 73
28.65	1.33	6 Jun 73	10 Jan 74
28.65	1.33	10 Jan 74	3 Apr 73
28.65	2.0	1 Jun 73	15 Apr 73
50.0	0.5	6 Feb 74	6 May 73
50.0	1.33	10 Feb 74	5 May 73

* All dates marked with an asterisk contain 180 pieces of data; all others contain 192.

e. Data were tabulated:

(1) For the grand mean.
(2) For the standard deviation (Std dev).
(3) For the mean and deviation by incident angles.
(4) For the mean and deviation by sample.
(5) By six error groups.

f. The data and data analyses are in Tables 6 through Table 20.

g. Table 21 is a compilation of the analysis data and includes the following:

(1) Overall mean.
(2) Overall standard deviation.
(3) Percentage of analyzed data pairs with values within 2 percent, within 10 percent, and within 20 percent.

Table 6. Data and Analysis – 26 May 73/17 Apr 73

BRIGHTNESS RATIO

FOLDED 15 FEET 1-1/3 DEGREE DIVERGENT ANGLE (26MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.7	10.8	10.9	9.9	9.84	9.62	9.15	7.54	6.17	4.49	2.94	2.06
2	20.7	20.4	20.3	19.8	19.21	17.15	14.92	12.88	11.19	7.59	2.63	.65
3	31.4	31.2	31.5	31.4	28.86	20.35	10.74	4.25	2.50	1.28	.47	.17
4	30.1	30.5	32.9	38.2	45.82	45.14	33.56	18.45	11.74	6.41	2.15	.57
5	34.0	33.5	33.7	32.3	28.77	22.11	14.57	7.04	4.73	2.58	.89	.27
6	3.0	3.0	3.0	2.9	2.47	1.57	.85	.41	.25	.13	.06	.04
7	5.9	5.9	5.9	5.9	5.89	5.25	4.03	2.58	1.81	1.05	.36	.10
8	18.2	18.0	17.2	16.5	14.81	11.57	7.35	4.07	2.53	1.29	.41	.08
9	15.7	15.3	15.4	13.9	10.12	5.84	3.13	1.52	1.00	.54	.24	.09
10	12.6	12.7	12.7	11.9	9.20	5.99	3.20	1.60	1.00	.56	.23	.08
11	6.5	6.4	6.3	5.6	4.25	2.89	1.70	.85	.55	.29	.12	.05
12	5.9	5.9	5.8	5.1	3.84	2.24	1.20	.58	.39	.21	.08	.03
13	3.5	3.6	3.5	3.3	2.95	2.53	2.10	1.68	1.34	1.16	1.04	1.05
14	2.9	2.8	2.5	2.1	1.76	1.55	1.42	1.22	1.12	1.05	1.22	1.41
15	2.0	1.9	1.9	1.8	1.66	1.54	1.39	1.17	1.07	1.02	1.04	.97
16	21.1	21.0	17.0	9.6	8.11	7.62	7.25	7.03	6.87	6.30	4.89	3.25

BRIGHTNESS RATIO

15 FEET 1-1/3 DEGREE DIVERGENT ANGLE (17APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.4	10.8	10.9	10.4	10.09	9.74	9.26	7.62	5.86	4.28	2.69	1.65
2	21.2	21.0	20.6	19.9	18.73	17.13	14.96	12.63	10.62	7.19	2.65	.63
3	32.8	33.1	32.6	31.3	26.68	17.63	8.80	3.48	2.04	1.07	.41	.13
4	29.0	30.0	32.6	38.6	48.18	48.01	36.30	18.85	12.07	6.24	2.09	.53
5	36.3	36.5	35.7	34.7	31.45	24.71	16.40	8.76	5.45	2.94	1.07	.35
6	3.3	3.2	3.2	3.2	2.62	1.66	.89	.40	.25	.14	.05	.07
7	6.1	6.2	6.2	6.1	5.95	5.37	4.16	2.70	1.96	1.14	.39	.14
8	19.5	19.4	18.6	17.6	15.45	12.15	8.05	4.21	2.68	1.46	.47	.16
9	16.1	16.0	16.0	14.2	10.27	6.08	3.16	1.53	1.03	.57	.24	.14
10	13.6	13.6	13.7	12.5	9.86	6.33	3.49	1.70	1.10	.60	.23	.18
11	6.4	6.4	6.1	5.4	4.16	2.85	1.70	.87	.56	.30	.11	.12
12	5.7	5.6	5.3	4.7	3.38	2.03	1.14	.58	.38	.20	.06	.03
13	4.5	4.5	4.4	4.1	3.67	3.18	2.55	1.90	1.56	1.20	1.00	1.01
14	2.8	2.8	2.5	2.2	1.78	1.67	1.63	1.40	1.21	1.05	1.07	1.26
15	2.2	2.2	2.0	1.9	1.69	1.52	1.37	1.16	1.05	.98	1.02	.93
16	22.6	23.0	17.1	9.8	8.59	7.99	7.65	7.29	7.03	6.31	4.92	3.41

Table 6. Data and Analysis – 26 May 73/17 Apr 73 (cont'd)

ANALYSIS

FOLDED 15 FEET 1-1/3 DEGREE DIVERGENT ANGLE (26MAY73)
15 FEET 1-1/3 DEGREE DIVERGENT ANGLE (17APR73)

	INCIDENT ANGLE											
	-4	10	20	30	40	50	60	70	75	80	85	88
1	2.9	0.0	0.0	-4.8	-2.48	-1.23	-1.19	-1.05	5.29	4.91	9.29	24.85
2	-2.4	-2.9	-1.5	-.5	2.56	.12	-.27	1.98	5.37	5.56	6.79	3.17
3	-4.3	-5.7	-3.4	.3	8.17	15.43	22.05	22.13	22.55	19.63	14.53	30.77
4	3.8	1.7	.9	-1.0	-4.90	-5.98	-7.22	-2.12	-2.73	2.72	2.87	7.55
5	-6.3	-8.2	-5.6	-6.9	-8.52	-10.52	-11.16	-19.63	-13.21	-12.24	-16.82	-22.86
6	-9.1	-6.3	-6.3	-9.4	-5.73	-5.42	-4.49	2.50	0.00	-7.14	20.00	-42.86
7	-3.3	-4.8	-4.8	-3.3	-1.01	-2.23	-3.12	-4.44	-7.65	-7.89	-7.69	-28.57
8	-6.7	-7.2	-7.5	-6.3	-4.14	-4.77	-8.70	-3.33	-5.60	-7.86	-12.77	-50.00
9	-2.5	-4.4	-3.8	-2.1	-1.46	-3.95	-.95	-.65	-2.91	-5.26	0.00	-35.71
10	-7.4	-6.6	-7.3	-4.8	-6.69	-5.37	-8.31	-5.58	-9.09	-6.67	0.00	-55.56
11	1.6	0.0	3.3	3.7	2.16	1.40	0.00	-2.30	-1.79	-3.33	9.09	-58.33
12	3.5	5.4	9.4	8.5	13.61	10.34	5.26	0.00	2.63	5.00	33.33	0.00
13	-22.2	-20.0	-20.5	-19.5	-19.62	-20.44	-17.65	-11.58	-14.10	-3.33	4.00	3.96
14	3.6	0.0	0.0	-4.5	-1.12	-7.19	-12.88	-12.86	-7.44	0.00	14.02	11.90
15	-9.1	-13.6	-5.0	-5.3	-1.78	1.32	1.46	.86	1.90	4.08	1.96	4.30
16	-6.6	-8.7	-.6	-2.0	-5.59	-4.63	-5.23	-3.57	-2.28	-.16	-.61	-4.69

GRAND MEAN= -3.1 STD DEV= 11.7

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-4.03	6.70	10	-5.09	6.14	20	-3.28	6.34
30	-3.62	6.04	40	-2.28	7.31	50	-2.70	8.05
60	-3.27	8.95	70	-2.50	8.85	75	-1.82	8.75
80	-.75	7.74	85	4.88	12.35	88	-13.25	28.62

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	3.04	7.90	2	1.51	3.24	3	11.86	12.47
4	-.37	4.41	5	-11.84	5.47	6	-6.18	14.04
7	-6.57	7.27	8	-10.40	12.71	9	-5.30	9.71
10	-10.30	14.43	11	-3.71	17.51	12	8.03	8.95
13	-13.41	9.65	14	-1.38	8.47	15	-1.57	5.58
16	-3.73	2.66						

LESS THAN 2%	21.35%
2-5%	29.17%
5-10%	26.65%
10-15%	7.81%
15-20%	4.17%
GREATER THAN 20%	8.85%

Table 7. Data and Analysis – 17 Jan 74/18 Apr 73

BRIGHTNESS RATIO

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (17JAN74)

INCIDENT ANGLE

	-4	1[illegible]	2[illegible]	3[illegible]	4[illegible]	5[illegible]	6[illegible]	7[illegible]	7[illegible]	8[illegible]	8[illegible]	9[illegible]
1	7.7	7.7	7.9	7.5	7.[illegible]9	6.98	6.77	5.99	5.11	3.98	2.81	2.26
2	15.2	15.1	15.1	15.1	15.01	1[illegible].82	12.61	9.51	8.24	5.63	2.93	.86
3	22.4	22.2	22.1	22.5	21.55	18.81	9.52	4.2[illegible]	2.[illegible]5	1.38	.51	.19
4	22.8	22.7	24.0	27.5	32.99	37.51	31.82	18.1[illegible]	11.58	5.1[illegible]	2.12	.61
5	24.1	24.1	24.3	24.5	22.51	19.1[illegible]	13.2[illegible]	7.5[illegible]	4.89	2.75	1.[illegible]9	.34
6	2.2	2.1	2.1	2.[illegible]	1.86	1.37	.79	.59	.28	.15	.06	.03
7	4.7	4.7	4.7	4.7	4.66	4.47	3.77	2.68	2.[illegible]0	1.16	.45	.14
8	12.4	12.2	12.3	11.9	11.16	9.47	6.74	4.09	2.77	1.5[illegible]	.54	.14
9	9.[illegible]	8.9	9.2	9.2	7.64	4.3[illegible]	2.87	1.54	1.[illegible]3	.5[illegible]	.28	.09
10	7.5	7.[illegible]	8.1	7.9	6.89	4.87	2.88	1.5[illegible]	.98	.5[illegible]	.24	.09
11	3.8	3.7	3.7	3.5	3.[illegible]3	2.25	1.48	.8[illegible]	.57	.33	.1[illegible]	.06
12	3.1	3.[illegible]	3.1	3.[illegible]	2.49	1.[illegible]8	.9[illegible]	.51	.37	.2[illegible]	.18	.03
13	3.5	3.[illegible]	3.[illegible]	3.[illegible]	3.09	2.64	2.1[illegible]	1.[illegible]6	1.39	1.07	.39	.90
14	2.6	2.[illegible]	2.6	2.[illegible]	1.72	1.54	1.39	1.19	1.[illegible]3	.95	1.03	1.32
15	1.6	1.[illegible]	1.5	1.[illegible]	1.[illegible]3	1.[illegible]4	1.22	1.1[illegible]	.99	.98	1.02	.89
16	9.7	9.[illegible]	7.9	[illegible].1	5.86	5.77	5.63	5.6[illegible]	5.48	5.06	4.17	3.06

15 FEET 2 DEGREE DIVERGENT ANGLE (18APR73)

INCIDENT ANGLE

	-4	1[illegible]	2[illegible]	3[illegible]	4[illegible]	5[illegible]	6[illegible]	7[illegible]	7[illegible]	8[illegible]	8[illegible]	8[illegible]
1	7.1	7.[illegible]	7.[illegible]	7.1	6.9[illegible]	6.93	6.7[illegible]	5.76	4.81	3.67	2.49	1.83
2	15.6	15.[illegible]	15.4	15.[illegible]	15.61	13.77	13.81	9.71	8.24	5.16	2.60	.71
3	21.9	22.[illegible]	21.7	22.[illegible]	21.8[illegible]	17.[illegible]1	10.[illegible]3	4.39	2.63	1.35	.49	.24
4	21.3	21.[illegible]	22.5	25.[illegible]	31.[illegible]4	35.3[illegible]	30.28	17.77	11.17	5.94	2.14	.52
5	22.5	22.[illegible]	23.[illegible]	25.1	21.47	18.[illegible]8	13.[illegible]4	7.57	4.91	2.83	1.11	.50
6	1.3	1.[illegible]	1.9	2.[illegible]	1.7[illegible]	1.27	.73	.57	.24	.14	.05	.11
7	4.4	4.[illegible]	4.4	4.5	4.51	4.28	3.61	2.48	1.79	1.07	.39	.19
8	11.4	11.[illegible]	11.3	11.1	1[illegible].39	8.[illegible]8	6.61	3.9[illegible]	2.7[illegible]	1.54	.54	.19
9	8.5	8.[illegible]	8.5	[illegible].5	7.[illegible]8	4.54	2.59	1.[illegible]5	.91	.54	.23	.10
10	7.1	7.2	7.5	7.[illegible]	6.[illegible]3	4.[illegible]6	2.77	1.44	.93	.53	.23	.1[illegible]
11	3.7	3.7	3.7	3.5	2.95	2.14	1.43	.79	.55	.31	.12	.12
12	2.3	3.[illegible]	3.1	3.[illegible]	2.45	1.64	.99	.52	.35	.2[illegible]	.07	.10
13	3.9	3.[illegible]	3.9	3.7	3.38	2.92	2.36	1.7[illegible]	1.47	1.14	.86	.83
14	2.3	2.[illegible]	2.3	2.[illegible]	1.72	1.62	1.55	1.29	1.13	.96	.88	.89
15	1.7	1.[illegible]	1.7	1.[illegible]	1.3[illegible]	1.4[illegible]	1.25	1.[illegible]8	.95	.88	.88	.81
16	8.9	8.7	7.5	5.8	5.67	5.35	5.54	5.51	5.43	5.11	4.20	3.27

Table 7. Data and Analysis – 17 Jan 74/18 Apr 73 (cont'd)

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (17JAN74)
15 FEET 2 DEGREE DIVERGENT ANGLE (18APR73)

INCIDENT ANGLE

	-4	1	2	3	4	5	6	7	75	8	85	88
1	8.5	9.2	6.8	5.3	1.87	.72	.59	3.99	6.24	8.45	16.87	23.50
4	-2.6	-3.2	-1.9	-2.3	-3.6	-5.02	-7.24	-2.02	0.00	2.76	12.69	21.13
8	2.3	.9	1.8	.9	-1.15	-3.45	-5.08	-2.98	.76	2.22	4.18	-25.00
4	9.1	8.6	6.7	7.1	4.53	4.54	1.76	2.19	3.67	2.69	-.93	17.31
5	7.1	6.7	5.7	5.2	3.91	3.54	1.61	2.31	-.41	-2.83	-1.80	-32.00
6	15.8	14.2	10.5	8.1	5.91	7.37	8.22	5.41	15.67	7.14	20.00	-72.73
7	6.9	6.6	6.9	6.4	3.77	4.44	4.43	8.06	11.73	8.41	15.38	-26.32
8	8.3	8.2	8.3	7.2	7.41	6.34	1.97	3.81	2.59	1.36	0.00	-26.32
9	8.3	8.1	8.2	8.2	9.14	7.38	10.81	14.07	13.19	11.11	21.74	-10.00
10	7.1	6.6	8.3	8.3	6.32	6.30	3.97	4.17	5.38	5.56	4.35	-10.00
11	2.7	1.4	0.3	2.9	2.71	5.14	3.56	1.27	3.64	6.45	16.67	-50.00
12	6.3	4.9	0.3	3.1	1.63	2.46	-3.33	-1.92	5.71	0.00	14.29	-70.00
13	-10.3	-10.3	-7.7	-8.1	-8.58	-8.59	-8.90	-5.14	-5.44	-6.14	3.49	8.43
14	4.1	4.6	0.3	0.1	0.06	-4.34	-11.32	-7.75	-8.85	-1.04	17.05	48.31
15	-5.3	-11.1	-11.8	-6.3	-4.67	-4.29	-2.48	4.76	4.21	11.36	15.91	9.88
16	9.3	8.9	5.3	5.2	3.21	3.96	1.62	1.63	.92	-.93	-.71	-6.42

GRAND MEAN= 1.9 STD DEV= 12.1

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	4.71	5.39	1	2.29	6.75	2	2.95	6.23
3	2.11	4.76	4	1.79	4.76	5	1.73	5.59
6	.13	5.91	7	1.99	5.27	7	3.75	6.46
8	3.54	3.09	8	9.94	8.37	8	-12.51	33.92

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	7.38	5.69	2	.49	8.30	3	-2.05	7.71
4	5.42	4.64	5	.11	10.38	6	2.78	24.44
7	4.57	10.27	8	2.28	9.49	9	8.66	7.35
10	4.07	4.53	11	-.42	16.22	12	-3.67	21.41
13	-5.53	5.81	14	3.37	15.93	15	-.02	9.05
16	2.64	4.18						

LESS THAN 2% 18.27%

2-5% 25.82%

5-10% 33.94%

10-15% 8.85%

15-20% 4.69%

GREATER THAN 20% 8.73%

Table 8. Data and Analysis – Apr 73/17 Jan 74

BRIGHTNESS RATIO

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (APR73)

INCIDENT ANGLE

	-5	10	20	30	40	50	60	70	75	80	85	88
1	7.5	7.6	7.7	7.5	7.07	7.06	6.78	5.74	4.90	3.78	2.81	2.14
2	16.1	15.1	15.2	15.3	16.45	16.20	14.72	9.89	8.36	6.58	3.22	1.06
3	22.7	21.7	21.4	21.4	21.11	16.88	9.27	5.86	2.34	1.21	.51	.37
4	22.1	22.9	23.9	27.1	33.66	35.53	30.66	17.85	12.12	6.58	2.45	.92
5	23.5	23.5	23.8	23.8	22.53	18.57	15.43	7.28	4.76	2.74	1.12	.54
6	2.1	1.8	1.9	1.9	1.70	1.39	.75	.35	.23	.13	.07	.05
7	4.5	4.5	4.5	4.6	4.63	4.52	3.73	2.53	1.81	1.09	.45	.15
8	11.1	11.1	11.0	10.7	10.17	8.49	5.46	3.64	2.43	1.39	.54	.18
9	8.1	8.1	8.3	7.8	6.54	4.52	2.35	1.21	.86	.52	.25	.10
10	7.1	7.1	7.4	7.8	7.05	4.94	2.89	1.48	1.01	.59	.27	.11
11	5.5	5.5	5.5	5.5	2.31	2.11	1.34	.75	.49	.29	.14	.07
12	2.8	2.9	3.0	2.8	2.37	1.54	.94	.49	.33	.20	.10	.05
13	3.2	3.1	3.1	3.1	2.65	2.16	1.84	1.44	1.20	1.07	1.02	.98
14	2.5	2.4	2.2	1.9	1.64	1.42	1.20	1.09	.96	.91	1.10	1.29
15	1.5	1.5	1.5	1.5	1.46	1.41	1.33	1.11	1.02	.99	.99	.83
16	8.3	8.6	7.3	5.7	5.55	5.49	5.42	5.39	5.28	5.06	4.53	3.43

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (17JAN74)

INCIDENT ANGLE

	-5	10	20	30	40	50	60	70	75	80	85	88
1	7.7	7.7	7.9	7.8	7.59	6.99	5.77	5.99	5.11	3.98	2.91	2.26
2	15.2	15.1	15.1	15.1	15.11	14.32	12.91	9.51	8.24	6.33	2.93	.86
3	22.4	22.2	22.1	22.3	21.55	15.31	8.52	4.65	2.65	1.33	.51	.18
4	22.3	22.7	24.5	27.5	32.39	37.51	31.82	18.15	11.58	6.10	2.12	.61
5	24.1	24.1	24.3	24.5	22.51	18.17	13.25	7.54	4.89	2.75	1.09	.34
6	2.2	2.1	2.1	2.1	1.86	1.57	.79	.39	.28	.15	.06	.03
7	4.7	4.7	4.7	4.7	4.68	4.47	3.77	2.68	2.01	1.16	.45	.14
8	12.4	12.2	12.3	11.9	11.16	9.47	6.74	4.09	2.77	1.56	.54	.14
9	8.2	8.5	8.2	8.2	7.54	4.93	2.87	1.56	1.03	.60	.28	.09
10	7.3	7.7	8.1	7.9	6.89	4.87	2.68	1.51	.98	.56	.24	.09
11	5.8	5.7	5.7	5.6	3.33	2.25	1.48	.81	.57	.33	.14	.06
12	3.1	3.1	3.1	3.0	2.49	1.58	.96	.51	.37	.20	.09	.03
13	3.5	3.5	3.6	3.4	3.09	2.34	2.15	1.66	1.39	1.07	.89	.90
14	2.3	2.3	2.3	2.1	1.72	1.54	1.39	1.19	1.03	.95	1.03	1.32
15	1.5	1.5	1.5	1.5	1.43	1.34	1.22	1.11	.99	.98	1.02	.89
16	9.7	9.3	7.9	6.1	5.80	5.77	5.63	5.61	5.48	5.06	4.17	3.06

Table 8. Data and Analysis – Apr 73/17 Jan 74 (cont'd)

ANALYSIS

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (APR73)
FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (17JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	-2.5	-1.3	-2.5	-2.7	-.28	.29	.15	-4.17	-4.11	-5.03	-3.44	-5.31
2	5.3	6.-	4.6	4.6	9.59	1.92	9.45	4.9-	1.46	3.95	3.90	23.26
3	-1.3	-2.9	-3.2	-4.3	-2.-4	-4.34	-2.68	-10.09	-11.7-	-12.32	0.-0	105.56
4	-3.1	-.7	-.3	-.7	2.03	-2.61	-.52	-1.71	4.66	7.87	15.37	50.82
5	-2.1	-2.5	-2.1	-1.3	.99	-2.77	1.36	-3.4-	-2.66	-.36	2.75	58.82
6	-9.1	-9.5	-9.5	-5.-	-5.38	-5.11	-7.59	-10.2-	-17.86	-13.53	16.67	66.67
7	-4.3	-4.3	-4.3	-2.1	-1.67	-3.56	-1.76	-5.6-	-9.50	-6.03	3.-0	7.14
8	-11.3	-9.9	-10.6	-10.1	-8.87	-10.35	-5.15	-11.--	-12.27	-10.90	0.00	28.57
9	-10.-	-9.1	-9.3	-10.2	-14.4-	-11.84	-18.12	-18.8-	-16.5-	-13.33	-11.71	11.11
10	-6.3	-6.0	-8.6	-1.3	2.32	1.44	.39	-1.33	3.06	5.36	12.50	22.22
11	-5.3	-5.4	-5.4	-9.3	-7.26	-6.22	-9.46	-8.7-	-14.04	-12.12	0.-0	16.67
12	-6.5	-5.3	-3.2	-6.7	-4.82	-3.33	-2.08	-3.92	-10.81	0.-0	25.-0	66.67
13	-8.3	-11.4	-13.9	-11.8	-13.27	-18.18	-14.42	-13.2-	-13.67	0.00	14.51	8.89
14	-3.3	-7.7	-4.3	-5.-	-4.65	-7.79	-9.35	-8.4-	-5.80	-4.21	5.-0	-2.27
15	0.3	0.0	6.7	1.-	2.10	5.22	9.02	7.0-	3.03	1.02	-2.94	-6.74
16	-8.2	-7.-	-7.5	-6.6	-5.29	-4.85	-3.73	-5.36	-3.65	0.-0	8.63	12.09

GRAND MEAN= -1.0 STD DEV= 14.4

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-4.87	4.24	10	-4.73	4.55	20	-4.63	5.44
30	-4.53	4.95	40	-3.14	6.17	50	-4.31	6.60
60	-3.50	7.36	70	-6.38	5.65	75	-6.96	7.40
80	-3.72	7.02	85	5.96	9.34	88	29.01	31.85

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	-2.58	1.95	2	7.67	5.66	3	4.19	32.18
4	5.92	15.12	5	3.97	17.41	6	-.78	22.80
7	-2.85	4.08	8	-5.93	11.40	9	-11.39	7.81
10	1.93	8.62	11	-5.47	7.84	12	3.50	21.37
13	-7.91	10.24	14	-4.8-	4.24	15	1.45	4.23
16	-2.67	6.52						

LESS THAN 2%	17.19%
2-5%	27.60%
5-10%	30.21%
10-15%	15.62%
15-20%	4.69%
GREATER THAN 20%	4.69%

Table 9. Data and Analysis – Apr 73/18 Apr 73

BRIGHTNESS RATIO

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (APR73)

	INCIDENT ANGLE											
	-4	15	20	30	40	50	60	70	75	80	85	88
1	7.3	7.5	7.7	7.5	7.47	7.20	6.76	5.75	4.90	3.78	2.91	2.14
2	15.3	15.1	15.3	15.2	16.45	16.29	14.02	9.89	8.36	6.58	3.22	1.06
3	22.3	21.7	21.4	21.4	21.11	15.08	9.27	5.85	2.34	1.21	.51	.37
4	22.1	22.6	23.3	27.1	35.66	35.53	30.66	17.85	12.12	6.58	2.45	.92
5	23.5	23.2	23.8	23.9	22.53	18.57	15.43	7.26	4.76	2.74	1.12	.54
6	2.1	1.9	1.9	1.9	1.76	1.57	.73	.35	.23	.15	.07	.05
7	4.5	4.5	4.5	4.6	4.65	4.32	3.73	2.55	1.81	1.09	.45	.15
8	11.1	11.1	11.2	10.7	10.17	8.49	6.46	3.64	2.43	1.39	.54	.18
9	8.1	8.2	8.3	7.8	6.54	4.32	2.35	1.25	.86	.52	.25	.10
10	7.1	7.1	7.4	7.8	7.24	4.94	2.89	1.48	1.01	.59	.27	.11
11	3.5	3.5	3.5	3.5	2.81	2.11	1.34	.75	.49	.29	.14	.07
12	2.3	2.3	3.3	2.3	2.57	1.54	.94	.49	.33	.20	.10	.05
13	3.2	3.1	3.1	3.1	2.68	2.16	1.84	1.44	1.20	1.07	1.02	.98
14	2.3	2.4	2.2	1.9	1.54	1.42	1.26	1.09	.96	.91	1.10	1.29
15	1.6	1.6	1.6	1.5	1.46	1.41	1.33	1.10	1.02	.99	.99	.83
16	8.3	8.2	7.3	6.7	6.55	6.49	6.42	5.80	5.28	5.06	4.53	3.43

15 FEET 2 DEGREE DIVERGENT ANGLE (18APR73)

	INCIDENT ANGLE											
	-4	15	20	30	40	50	60	70	75	80	85	88
1	7.1	7.3	7.4	7.1	6.85	6.93	6.75	5.76	4.81	3.57	2.49	1.83
2	15.3	15.6	15.4	15.5	15.81	15.77	13.81	9.71	8.21	6.15	2.60	.71
3	21.3	22.1	21.7	22.3	21.90	17.41	11.83	4.59	2.63	1.55	.49	.24
4	21.3	21.3	22.5	25.3	31.54	35.35	30.28	17.77	11.17	5.94	2.14	.52
5	22.5	22.9	23.1	23.1	21.47	13.18	13.04	7.57	4.91	2.83	1.11	.50
6	1.9	1.8	1.9	2.1	1.79	1.27	.73	.37	.24	.14	.05	.11
7	4.4	4.5	4.4	4.3	4.51	4.29	3.61	2.45	1.79	1.17	.39	.19
8	11.4	11.5	11.3	11.1	10.39	8.58	6.61	3.94	2.75	1.54	.34	.19
9	8.3	8.3	8.3	8.1	7.21	4.54	2.59	1.35	.91	.54	.23	.10
10	7.1	7.2	7.5	7.6	6.63	4.56	2.77	1.44	.93	.53	.23	.10
11	3.7	3.7	3.7	3.3	2.95	2.14	1.48	.79	.55	.31	.12	.12
12	2.3	3.1	3.1	3.1	2.45	1.54	.99	.52	.35	.20	.07	.10
13	3.3	3.3	3.3	3.7	3.58	2.92	2.36	1.75	1.47	1.14	.86	.83
14	2.3	2.5	2.3	2.3	1.72	1.52	1.35	1.20	1.13	.96	.88	.89
15	1.7	1.8	1.7	1.5	1.36	1.43	1.25	1.05	.95	.88	.88	.81
16	8.3	8.7	7.3	6.8	6.57	6.53	6.54	5.61	5.43	5.11	4.20	3.27

Table 9. Data and Analysis – Apr 73/18 Apr 73 (cont'd)

ANALYSIS

FOLDED 15 FEET 2 DEGREE DIVERGENT ANGLE (APR73)
15 FEET 2 DEGREE DIVERGENT ANGLE (18APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	56	70	75	80	85	86
1	5.6	4.1	4.1	2.8	1.68	1.01	.74	-.35	1.87	3.10	12.35	16.94
2	2.0	2.3	2.6	1.9	4.05	3.30	1.52	1.84	1.46	6.82	23.35	49.30
3	.5	-1.4	-1.4	-4.3	-3.17	-7.64	-7.58	-12.70	-11.03	-10.37	4.18	54.17
4	5.7	2.8	6.2	6.3	6.72	1.61	1.25	.45	8.50	10.77	14.49	76.92
5	4.9	3.1	3.5	3.3	4.94	2.71	2.00	-1.22	-3.05	-3.18	.90	8.00
6	5.3	0.0	0.0	-5.8	-1.98	2.56	5.81	-5.41	-4.17	-7.14	40.00	-54.55
7	2.3	0.0	2.3	2.2	2.66	.93	3.32	2.02	1.12	1.87	15.38	-21.05
8	-3.5	-5.2	-2.7	-3.6	-2.12	-4.30	-2.27	-7.61	-10.00	-9.74	0.00	-5.26
9	-4.7	-3.9	-2.4	-8.2	-6.57	-4.38	-9.27	-7.41	-5.49	-3.76	8.70	0.00
10	0.0	-1.4	-1.3	2.6	5.33	8.56	4.33	2.70	8.60	11.32	17.39	10.00
11	-2.7	-5.4	-5.4	-5.7	-4.75	-1.40	-6.29	-7.56	-10.91	-6.45	15.67	-41.67
12	0.0	-3.3	-3.2	-6.7	-3.27	-5.13	-2.15	-5.77	-5.71	0.00	+2.86	-50.00
13	-17.9	-20.5	-20.5	-18.9	-20.71	-25.03	-22.03	-17.71	-18.37	-6.14	18.60	18.07
14	0.9	-4.1	-4.3	-5.1	-4.65	-12.35	-18.71	-15.56	-15.14	-5.21	25.30	44.94
15	-5.9	-11.1	-5.9	-6.3	-2.67	.71	6.40	4.79	7.37	12.50	12.50	2.47
16	0.0	-1.1	-2.7	-1.7	-.36	-1.08	-2.17	-3.81	-2.76	-.98	7.86	4.89

GRAND MEAN= -.0 STD DEV= 13.9

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-.53	5.90	10	-2.60	5.36	20	-1.95	6.09
30	-2.85	6.15	40	-1.48	6.59	50	-2.68	7.98
60	-3.37	8.02	70	-4.58	9.68	75	-3.60	9.17
80	-.41	7.49	85	15.32	12.16	88	7.07	37.41

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	4.52	5.19	2	8.48	14.27	3	-.05	17.31
4	12.45	20.81	5	2.25	3.35	6	-2.53	20.58
7	1.08	8.03	8	-4.69	3.06	9	-3.98	4.74
10	5.73	5.68	11	-6.85	12.93	12	-3.86	19.92
13	-12.48	15.21	14	-1.24	19.35	15	1.24	7.73
16	-.33	3.37						

LESS THAN 2%	21.65%
2-5%	31.77%
5-10%	25.00%
10-15%	5.25%
15-20%	5.77%
GREATER THAN 20%	8.85%

Table 10. Data and Analysis – 19 Feb 74/2 May 73

BRIGHTNESS RATIO

FOLDED 15 FEET 5 DEGREE DIVERGENT ANGLE (19FEB74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	3.5	3.6	3.7	3.8	3.85	3.91	3.77	3.45	3.12	2.74	2.36	2.34
2	3.3	3.9	4.0	4.4	5.01	5.71	6.16	6.11	5.47	4.68	2.25	1.13
3	5.3	5.5	5.3	5.9	6.64	7.51	6.45	4.15	2.91	1.70	.79	.49
4	9.2	9.2	9.2	9.5	9.78	11.54	14.11	13.14	10.53	6.86	3.08	1.24
5	6.2	6.1	6.4	7.2	7.79	7.75	6.79	5.50	4.22	2.90	1.50	.83
6	.3	.3	.3	.4	.43	.42	.34	.21	.16	.11	.12	.23
7	1.2	1.2	1.3	1.3	1.37	1.38	1.35	1.25	1.10	.82	.45	.31
8	2.3	2.8	2.9	3.1	3.17	3.27	2.92	2.39	1.98	1.42	.72	.47
9	2.5	2.5	2.5	2.5	2.78	2.46	1.73	1.15	.96	.58	.38	.35
10	1.7	1.7	1.7	2.0	2.35	2.33	1.84	1.28	.96	.64	.34	.25
11	1.2	1.2	1.2	1.2	1.21	1.10	.88	.64	.48	.34	.24	.29
12	.7	.7	.8	.9	.95	.83	.61	.45	.34	.24	.18	.26
13	1.8	1.8	1.8	1.7	1.59	1.43	1.22	1.02	.89	.80	.72	.76
14	1.7	1.7	1.6	1.4	1.31	1.18	1.04	.87	.76	.66	.60	.66
15	1.1	1.1	1.0	.9	.86	.81	.74	.67	.64	.59	.58	.55
16	2.2	2.2	2.0	2.0	2.10	2.33	2.48	2.65	2.74	2.84	2.89	2.88

15 FEET 5 DEGREE DIVERGENT ANGLE (2MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	3.4	3.4	3.4	3.4	3.45	3.53	3.39	3.08	2.76	2.41	2.08	2.10
2	3.8	3.7	3.8	4.2	4.64	5.59	5.85	5.89	5.32	4.42	2.02	.97
3	5.1	5.1	4.9	5.3	6.10	6.52	5.51	3.42	2.31	1.37	.61	.25
4	8.4	8.5	8.4	8.6	9.34	10.90	13.29	12.12	9.54	6.15	2.82	1.15
5	5.3	5.3	5.3	6.3	7.11	7.54	6.22	4.86	3.73	2.51	1.26	.58
6	.4	.4	.4	.4	.52	.53	.39	.26	.19	.12	.06	.03
7	1.4	1.4	1.4	1.5	1.51	1.54	1.40	1.30	1.23	.91	.45	.19
8	2.5	2.6	2.7	2.9	2.95	2.90	2.68	2.21	1.80	1.24	.60	.26
9	2.3	2.3	2.3	2.4	2.49	2.19	1.59	1.09	.80	.53	.29	.14
10	1.4	1.4	1.4	1.5	1.51	1.84	1.45	1.00	.75	.49	.24	.10
11	.9	.9	.9	.9	.89	.82	.66	.48	.37	.26	.14	.07
12	.5	.5	.5	.5	.66	.59	.44	.31	.24	.16	.08	.03
13	1.8	1.8	1.7	1.7	1.57	1.41	1.10	.99	.87	.73	.66	.70
14	1.5	1.5	1.4	1.5	1.29	1.10	.97	.81	.73	.60	.52	.58
15	.9	.9	.9	.9	.84	.81	.74	.67	.63	.59	.56	.52
16	2.1	2.1	2.0	1.9	2.05	2.32	2.42	2.58	2.65	2.70	2.79	3.05

Table 10. Data and Analysis – 19 Feb 74/2 May 73 (cont'd)

ANALYSIS

FOLDED 15 FEET 5 DEGREE DIVERGENT ANGLE (19FEB74)
15 FEET 2 DEGREE DIVERGENT ANGLE (2MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	5.3	5.3	8.8	11.3	11.66	10.76	11.21	11.36	13.04	13.59	13.46	11.43
2	2.5	2.7	5.3	4.3	7.75	5.94	5.66	5.57	2.82	5.86	11.33	16.49
3	10.0	7.8	8.2	9.4	8.85	10.42	17.06	21.64	25.97	24.09	29.51	96.00
4	9.5	8.2	9.5	8.1	9.19	5.87	6.17	8.42	10.38	11.54	9.22	7.83
5	12.7	10.9	10.3	9.1	9.56	5.59	9.16	9.96	13.14	15.54	19.05	43.10
6	-25.0	-25.0	-25.0	0.5	-17.51	-20.75	-12.82	-19.23	-15.79	-8.33	100.00	66.67
7	-14.3	-14.3	-7.1	-13.5	-9.27	-10.59	-9.40	-10.07	-10.57	-9.89	-2.17	63.16
8	7.7	7.7	7.4	7.1	7.46	10.34	8.96	8.14	10.00	14.52	20.00	80.77
9	8.7	8.7	8.7	8.3	11.65	12.33	8.61	7.62	7.50	9.43	31.03	150.00
10	21.4	21.4	21.4	25.0	29.83	25.63	26.91	23.00	28.00	30.61	41.67	150.00
11	33.3	33.3	33.3	33.3	35.96	34.15	33.33	33.33	29.73	30.77	71.43	314.29
12	40.0	40.0	60.0	51.3	43.34	40.58	38.64	39.71	41.67	50.00	125.00	766.67
13	0.0	0.0	5.9	0.0	1.27	1.42	2.52	3.03	2.30	9.59	9.09	8.57
14	13.3	13.3	14.3	7.7	9.17	7.27	7.22	7.41	4.11	10.00	15.38	13.79
15	11.1	11.1	11.1	0.0	2.38	0.00	1.00	1.00	1.59	0.00	3.57	5.77
16	4.8	4.8	0.0	5.3	2.44	.43	2.49	2.71	3.40	5.19	3.58	-5.57

GRAND MEAN= 23.4 STD DEV= 78.6

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	8.86	15.48	10	8.54	15.45	20	10.76	17.99
30	10.41	14.80	40	11.22	15.38	50	8.79	15.21
60	9.74	13.79	70	9.66	14.94	75	10.46	14.93
80	13.23	15.10	85	31.33	56.61	88	149.71	236.88

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	10.75	2.62	2	6.24	4.07	3	22.42	24.45
4	8.59	1.61	5	14.01	9.79	6	49.79	197.29
7	-3.97	21.33	8	15.84	20.79	9	22.73	40.59
10	37.53	55.83	11	59.63	80.95	12	111.27	207.79
13	3.64	3.67	14	10.25	3.64	15	3.89	4.70
16	2.45	3.06						

LESS THAN 2%	7.29%
2-5%	9.90%
5-10%	32.81%
10-15%	18.23%
15-20%	4.69%
GREATER THAN 20%	27.08%

Table 11. Data and Analysis – 4 Dec 73/31 Mar 73

BRIGHTNESS RATIO

FOLDED 28.65 FEET .7 DEGREE DIVERGENCE ANGLE (4DEC73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	12.8	13.1	13.5	13.2	13.33	13.08	12.54	9.85	7.32	4.55	2.25	1.15
2	35.1	34.9	34.2	33.9	31.06	28.92	25.09	18.56	13.44	7.49	2.22	.78
3	56.3	59.9	59.0	56.9	47.19	31.87	14.70	5.49	3.13	1.67	1.17	2.20
4	61.3	62.5	57.5	52.4	43.79	30.03	18.34	9.09	5.59	3.05	1.66	2.64
5	5.3	5.2	5.1	4.7	3.56	2.05	1.02	.53	.44	.41	.77	2.21
6	9.0	9.2	9.1	9.1	8.47	7.02	5.24	3.33	2.36	1.51	1.04	2.22
7	38.7	38.2	35.9	31.9	20.23	18.55	11.32	5.49	3.30	1.78	1.05	2.08
8	38.2	37.0	34.5	27.6	17.20	8.42	4.12	1.91	1.27	.89	.92	2.19
9	28.3	28.1	26.1	22.2	16.18	8.74	4.39	2.16	1.39	1.03	1.09	2.58
10	17.2	15.9	14.2	11.6	8.31	5.00	2.77	1.35	.93	.67	.83	2.20
11	14.3	14.3	13.5	11.1	7.58	4.19	2.16	1.02	.73	.64	.98	2.67
12	4.5	4.5	4.3	3.9	3.38	2.83	2.40	1.87	1.59	1.40	1.29	1.18
13	3.4	3.3	3.0	2.6	2.26	2.24	2.24	1.84	1.11	1.23	1.11	1.17
14	2.7	2.6	2.5	2.3	2.02	1.74	1.52	1.26	1.12	1.11	1.21	1.62
15	70.5	70.1	47.2	18.4	12.64	10.90	9.98	9.00	8.29	7.20	4.78	2.67

29.65 FEET .7 DIVERGENT ANGLE (31 MAR 73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	12.9	13.6	14.4	13.6	13.79	13.01	12.84	9.82	7.06	4.51	2.29	1.18
2	39.5	40.5	41.1	39.5	36.17	31.45	26.71	18.13	12.92	7.22	1.98	.57
3	67.2	68.5	69.4	66.7	48.73	31.52	14.44	5.15	2.83	1.45	.66	.81
4	65.1	66.7	64.4	58.5	45.71	29.94	17.34	8.91	4.77	2.55	.99	.87
5	5.5	4.8	4.8	4.2	2.88	1.58	.76	.34	.24	.20	.31	.68
6	9.3	9.1	9.1	8.3	7.90	6.29	4.42	2.56	1.74	.94	.51	.75
7	43.8	44.4	42.5	38.6	29.23	20.33	12.15	5.47	3.41	1.66	.82	.80
8	45.8	45.8	41.8	31.1	18.89	9.15	4.24	1.88	1.21	.79	.49	.77
9	32.3	33.3	31.7	27.1	18.50	10.19	4.83	2.22	1.47	.80	.56	.97
10	20.3	20.4	18.3	14.7	9.56	5.62	2.90	1.28	.83	.50	.43	.72
11	19.2	19.3	17.5	13.5	8.42	4.46	2.18	.95	.64	.45	.62	1.35
12	5.1	5.1	4.8	4.2	3.57	3.01	2.50	1.93	1.67	1.41	1.27	1.05
13	3.5	3.5	3.3	2.7	2.32	2.21	2.22	1.79	1.56	1.20	1.09	1.08
14	2.9	3.0	2.8	2.4	2.12	1.72	1.43	1.15	1.05	1.09	1.03	.80
15	83.2	83.9	55.7	18.5	12.75	11.18	9.87	8.57	7.75	6.77	4.32	2.12

Table 11. Data and Analysis – 4 Dec 73/31 Mar 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET .7 DEGREE DIVERGENCE ANGLE (4DEC73)
28.65 FEET .7 DIVERGENT ANGLE (31 MAR 73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	-.8	-3.7	-6.2	-2.3	-3.54	-3.89	-2.34	.51	3.68	.89	-1.75	-2.54
2	-11.4	-14.1	-15.8	-14.6	-11.92	-8.94	-6.07	2.57	11.81	3.74	12.12	36.94
3	-10.0	-12.6	-15.0	-10.7	-5.16	-2.06	1.80	7.65	15.60	15.17	77.27	171.60
4	-5.1	-7.9	-10.7	-7.4	.18	.37	5.77	13.62	17.19	19.61	67.58	203.45
5	10.0	8.3	6.2	11.9	21.53	29.75	34.21	55.88	83.33	105.00	148.39	225.00
6	6.7	1.1	0.0	3.4	7.22	11.61	18.55	31.62	35.63	60.54	103.32	196.00
7	-11.6	-14.4	-15.5	-13.1	-10.26	-8.76	-6.83	.57	-3.23	7.23	28.05	160.00
8	-16.5	-17.2	-17.5	-11.3	-3.95	-7.98	-2.83	1.51	4.96	27.14	87.76	184.42
9	-14.0	-15.9	-17.7	-17.8	-13.55	-14.23	-8.11	-5.41	-.71	28.75	94.64	165.98
10	-17.7	-22.1	-22.4	-17.1	-12.53	-11.03	-4.48	5.47	12.05	54.07	93.02	205.56
11	-22.4	-23.3	-23.3	-17.9	-8.98	-6.82	-1.90	7.57	14.06	42.22	58.06	97.78
12	-10.0	-10.5	-10.4	-7.1	-5.32	-5.99	-4.68	-3.11	-4.79	-.71	1.57	12.38
13	-5.5	-5.7	-9.1	-5.7	-2.59	1.56	.90	2.79	-28.85	2.50	1.83	8.33
14	-6.9	-13.5	-10.7	-4.2	0.00	1.16	6.29	9.57	6.67	1.83	17.49	102.50
15	-15.3	-16.4	-15.3	-1.2	-.86	-1.62	.30	5.92	6.97	6.35	11.63	25.94

GRAND MEAN= 14.5 STD DEV= 47.1

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-8.17	10.19	10	-11.12	8.47	20	-12.29	7.91
30	-7.53	8.42	40	-3.57	9.06	50	-1.75	10.73
60	2.02	11.18	70	9.01	15.60	75	11.29	24.19
80	23.82	28.74	85	55.38	46.91	88	119.55	83.34

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	-1.89	2.61	2	-1.33	15.69	3	19.22	53.93
4	24.72	60.15	5	62.31	67.59	6	39.70	57.37
7	9.36	48.96	8	18.63	59.90	9	15.09	57.35
10	20.23	66.89	11	9.50	38.06	12	-3.96	6.33
13	-3.15	9.39	14	9.20	30.69	15	.38	12.21

LESS THAN 2%	13.89%
2-5%	13.33%
5-10%	22.22%
10-15%	17.22%
15-20%	11.11%
GREATER THAN 20%	22.22%

Table 12. Data and Analysis – 4 Dec 73/9 Jan 74

BRIGHTNESS RATIO

FOLDED 28.65 FEET .7 DEGREE DIVERGENCE ANGLE (4DEC73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	12.9	13.1	13.5	13.2	13.33	13.08	12.54	9.85	7.32	4.55	2.25	1.15
2	35.1	34.8	34.2	33.8	31.86	28.92	25.09	18.56	13.44	7.49	2.22	.78
3	60.5	59.9	59.0	56.9	47.19	30.87	14.70	5.49	3.13	1.67	1.17	2.20
4	61.8	60.5	57.5	52.4	43.79	30.03	18.34	9.09	5.59	3.05	1.66	2.64
5	5.9	5.2	5.1	4.7	3.50	2.05	1.02	.53	.44	.41	.77	2.21
6	9.6	9.2	9.1	9.1	8.47	7.02	5.24	3.33	2.36	1.51	1.04	2.22
7	38.7	38.2	35.9	31.8	26.23	18.55	11.32	5.49	3.30	1.78	1.05	2.08
8	38.2	37.9	34.5	27.6	17.20	8.42	4.12	1.91	1.27	.89	.92	2.19
9	28.3	28.0	26.1	22.2	16.08	8.74	4.39	2.10	1.39	1.03	1.09	2.58
10	17.2	16.9	14.2	11.6	8.31	5.00	2.77	1.35	.93	.67	.83	2.20
11	14.9	14.8	13.5	11.1	7.58	4.10	2.06	1.02	.73	.64	.98	2.67
12	4.5	4.5	4.3	3.9	3.38	2.83	2.40	1.87	1.59	1.40	1.29	1.18
13	3.4	3.3	3.0	2.6	2.26	2.24	2.24	1.84	1.11	1.23	1.11	1.17
14	2.7	2.6	2.5	2.3	2.02	1.74	1.52	1.26	1.12	1.11	1.21	1.62
15	70.5	70.1	47.2	18.4	12.64	13.90	9.90	9.00	8.29	7.20	4.78	2.67

FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	13.2	13.4	13.9	13.6	13.67	13.64	12.71	10.19	7.80	4.75	2.48	1.47
2	35.5	35.1	34.9	34.4	32.23	29.28	25.00	18.55	13.70	7.60	2.28	.80
3	60.6	59.8	59.5	57.2	46.94	30.90	14.56	5.44	3.12	1.66	1.20	2.26
4	62.2	61.6	59.4	54.5	44.18	31.14	18.26	9.18	5.62	3.00	1.53	2.46
5	5.4	5.3	5.2	4.9	3.65	2.07	1.09	.59	.49	.47	.78	2.10
6	9.2	9.1	9.2	9.1	8.34	6.97	5.15	3.24	2.30	1.41	1.00	2.01
7	38.6	38.4	35.9	32.9	26.20	18.59	11.40	5.59	3.44	1.86	1.09	2.01
8	38.0	37.9	34.7	27.4	16.96	8.62	4.05	1.86	1.26	.88	.90	2.01
9	28.4	28.1	26.3	22.9	15.97	8.98	4.54	2.17	1.49	1.02	1.01	2.25
10	16.1	15.7	14.4	11.6	8.11	4.89	2.75	1.36	.94	.69	.85	2.08
11	14.9	14.6	13.5	11.1	7.58	4.12	2.04	1.04	.77	.62	.93	2.45
12	4.4	4.4	4.2	3.8	3.29	2.73	2.34	1.80	1.55	1.30	1.17	.95
13	3.3	3.2	2.8	2.5	2.11	2.05	2.05	1.69	1.40	1.09	.99	1.08
14	2.6	2.5	2.4	2.3	1.95	1.69	1.48	1.25	1.14	1.06	1.15	1.46
15	68.8	67.0	46.2	18.0	12.09	13.59	9.53	8.61	7.91	6.51	4.08	1.93

Table 12. Data and Analysis – 4 Dec 73/9 Jan 74 (cont'd)

ANALYSIS

FOLDED 28.65 FEET .7 DEGREE DIVERGENCE ANGLE (4DEC73)
FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	-3.0	-2.2	-2.9	-2.9	-2.49	-4.11	-1.34	-3.34	-5.15	-4.21	-9.27	-21.77
2	-1.1	-.9	-2.0	-1.7	-1.15	-1.23	.36	.05	-1.90	-1.45	-2.63	-2.50
3	-.2	.2	-.8	-.5	.53	-.10	.96	.92	.32	.60	-2.50	-2.65
4	-.6	-1.8	-3.2	-3.9	-.88	-3.56	.44	-.76	-.53	1.67	8.50	7.32
5	9.3	-1.9	-1.9	-4.1	-4.11	-.97	-6.42	-10.17	-10.20	-12.77	-1.28	5.24
6	4.3	1.1	-1.1	0.0	1.56	.72	1.75	2.78	2.61	7.09	4.30	10.45
7	.3	.5	0.0	-3.9	.11	.87	-.70	-1.79	-4.07	-4.30	-3.67	3.48
8	-1.3	.3	-.6	.7	1.42	-2.32	1.73	2.69	.79	1.14	2.22	8.96
9	-.4	-.4	-.8	-3.1	.69	-2.67	-3.30	-3.23	-5.71	.98	7.92	14.67
10	6.8	1.3	-1.4	0.0	2.47	2.25	.73	-.74	-1.06	-2.90	-2.35	5.77
11	0.0	1.4	-.7	0.0	2.71	-.49	.98	-1.92	-5.19	3.23	5.38	8.98
12	2.3	2.3	2.4	2.6	2.74	3.66	2.56	3.89	2.58	7.59	10.26	24.21
13	3.0	3.1	7.1	4.0	7.11	9.27	9.27	8.88	-20.71	12.84	12.12	8.33
14	3.8	4.0	4.2	0.0	3.59	2.96	2.70	.80	-1.75	4.72	5.22	10.96
15	2.5	3.2	2.2	2.5	4.55	1.96	3.88	4.53	4.80	10.60	17.16	38.34

GRAND MEAN= 1.2 STD DEV= 6.0

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	1.73	3.31	10	.68	1.93	20	.03	2.81
30	-.63	2.48	40	1.26	2.83	50	.42	3.39
60	.91	3.44	70	.17	4.34	75	-3.15	6.31
80	1.66	6.51	85	3.40	7.09	88	7.99	13.06

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	-5.31	5.59	2	-1.35	.91	3	-.27	1.20
4	.22	3.94	5	-3.28	6.32	6	2.94	3.21
7	-1.03	2.38	8	1.33	2.79	9	.32	5.73
10	.91	3.03	11	1.19	3.62	12	5.60	6.37
13	5.37	8.80	14	3.43	3.15	15	8.02	10.52

LESS THAN 2%	41.11%
2-5%	37.22%
5-10%	13.33%
10-15%	5.56%
15-20%	.56%
GREATER THAN 20%	2.22%

Table 13. Data and Analysis – 9 Jan 74/31 Mar 73

BRIGHTNESS RATIO

FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	16.2	15.4	13.9	13.9	13.67	13.04	12.71	10.19	7.80	4.75	2.48	1.47
2	35.5	35.1	34.9	34.4	32.25	29.28	25.00	18.55	13.72	7.50	2.28	.80
3	60.5	59.8	59.5	57.2	46.94	33.30	14.56	5.44	3.12	1.66	1.20	2.26
4	62.2	61.6	59.4	54.5	44.18	31.14	18.26	9.16	5.62	3.00	1.53	2.46
5	5.4	5.3	5.2	4.9	3.65	2.07	1.09	.59	.49	.47	.78	2.10
6	9.2	9.1	9.2	9.1	8.54	6.97	5.15	3.24	2.30	1.41	1.00	2.01
7	38.5	38.1	35.9	32.8	20.21	13.59	11.40	5.59	3.44	1.86	1.09	2.01
8	38.5	37.8	34.7	27.4	15.96	8.52	4.05	1.86	1.26	.38	.90	2.01
9	28.4	28.1	26.3	22.9	15.97	8.93	4.54	2.17	1.49	1.02	1.01	2.25
10	16.1	15.7	14.4	11.6	8.11	4.89	2.75	1.36	.94	.69	.35	2.08
11	14.9	14.6	13.6	11.1	7.38	4.12	2.04	1.04	.77	.62	.93	2.45
12	4.4	4.4	4.2	3.8	3.29	2.73	2.34	1.80	1.55	1.30	1.17	.95
13	3.3	3.2	2.8	2.5	2.11	2.05	2.05	1.59	1.40	1.29	.99	1.08
14	2.6	2.5	2.4	2.3	1.95	1.69	1.48	1.25	1.14	1.06	1.15	1.46
15	68.3	67.9	46.2	18.1	12.09	10.69	9.53	8.61	7.91	6.51	4.18	1.93

28.65 FEET .7 DIVERGENT ANGLE (31 MAR 73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	12.9	13.6	14.4	13.6	13.79	13.61	12.84	9.82	7.06	4.51	2.29	1.18
2	39.5	40.5	41.1	39.6	36.17	31.45	26.71	18.13	12.02	7.22	1.98	.57
3	67.2	68.5	69.4	65.7	48.75	31.52	14.44	5.10	2.83	1.45	.65	.81
4	65.1	65.7	64.4	58.5	40.71	23.94	17.34	8.00	4.77	2.55	.99	.87
5	5.0	4.8	4.8	4.2	2.88	1.58	.76	.54	.24	.20	.31	.68
6	9.1	9.1	9.1	8.3	7.90	5.29	4.42	2.53	1.74	.94	.51	.75
7	43.8	44.4	42.5	38.6	29.23	20.33	12.15	5.47	3.41	1.66	.82	.80
8	45.8	45.8	41.8	31.1	18.89	9.15	4.24	1.88	1.21	.73	.49	.77
9	32.9	33.3	31.7	27.9	18.50	10.19	4.83	2.22	1.40	.80	.56	.97
10	20.9	20.4	18.3	14.9	9.50	5.52	2.90	1.26	.83	.50	.43	.72
11	19.2	19.3	17.6	15.5	8.42	4.40	2.10	.95	.64	.45	.62	1.35
12	5.0	5.0	4.8	4.2	3.57	3.01	2.50	1.93	1.67	1.41	1.27	1.05
13	3.6	3.5	3.3	2.7	2.32	2.21	2.22	1.79	1.56	1.20	1.19	1.08
14	2.9	3.0	2.8	2.4	2.02	1.72	1.43	1.15	1.05	1.09	1.13	.80
15	83.2	83.9	55.7	16.9	12.75	11.08	9.87	8.57	7.75	6.77	4.32	2.12

Table 13. Data and Analysis – 9 Jan 74/31 Mar 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)
28.65 FEET .7 DIVERGENT ANGLE (31 MAR 73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	2.3	-1.3	-3.5	[illegible]	-.87	.22	-1.01	3.77	10.48	5.32	8.30	24.58
2	-10.4	-13.3	-15.1	-13.1	-10.89	-6.90	-6.40	2.32	13.98	5.26	15.15	40.35
3	-9.8	-12.7	-14.3	-11.2	-3.67	-1.97	.83	8.67	10.25	14.48	61.82	179.01
4	-4.5	-8.2	-7.8	-3.7	1.08	4.01	5.31	14.56	17.82	17.65	54.55	182.76
5	8.0	10.4	9.3	16.7	26.74	31.91	43.42	73.53	104.17	135.00	151.61	208.32
6	2.2	0.6	1.1	3.4	5.57	10.81	16.52	28.06	32.18	50.00	96.08	168.00
7	-11.9	-14.4	-15.6	-10.4	-10.37	-9.5[illegible]	-6.17	2.19	.88	12.05	32.93	151.25
8	-15.7	-17.5	-17.3	-11.3	-10.22	-5.79	-4.48	-1.06	4.13	25.71	83.67	161.04
9	-16.7	-15.6	-17.[illegible]	-15.2	-14.14	-11.87	-6.01	-2.23	5.43	27.50	80.36	131.96
10	-23.1	-23.[illegible]	-21.3	-17.1	-14.53	-12.99	-5.17	6.25	13.25	38.00	97.67	188.89
11	-22.4	-24.4	-22.7	-17.3	-12.35	-6.36	-2.86	9.47	20.31	37.78	50.00	81.48
12	-12.0	-12.[illegible]	-12.5	-9.5	-7.84	-9.50	-6.46	-5.74	-7.19	-7.80	-7.87	-9.52
13	-0.3	-3.6	-15.2	-7.4	-9.35	-7.24	-7.66	-5.59	-10.26	-9.17	-9.17	0.00
14	-10.3	-16.7	-14.3	-4.2	-3.47	-1.74	3.51	8.74	8.57	-2.75	11.65	82.50
15	-17.3	-19.1	-17.1	-3.5	-5.18	-3.52	-3.44	.47	2.06	-3.34	-5.56	-8.96

GRAND MEAN= 15.0 STD DEV= 44.6

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-9.78	8.81	10	-11.64	9.25	20	-12.25	8.43
30	-6.94	8.96	40	-4.62	10.42	50	-2.08	11.05
60	1.33	13.24	70	9.36	19.76	75	15.14	26.80
80	23.11	55.92	85	49.41	48.15	88	105.48	79.35

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	4.81	7.71	2	.98	15.45	3	20.94	56.30
4	22.95	56.15	5	68.14	87.04	6	34.50	50.40
7	15.98	46.54	8	18.91	53.70	9	12.54	46.82
10	18.91	53.82	11	7.52	33.74	12	-9.06	2.13
13	-8.13	3.45	14	5.12	25.97	15	-7.08	7.05

LESS THAN 2%	8.33%
2-5%	13.33%
5-10%	25.00%
10-15%	19.44%
15-20%	11.11%
GREATER THAN 20%	22.78%

Table 14. Data and Analysis – 9 Jan 74/31 Mar 73

BRIGHTNESS RATIO*

FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	13.2	13.4	13.9	13.6	13.67	13.64	12.71	10.19	7.80	4.75	2.48	1.47
2	35.5	35.1	34.9	34.4	32.23	29.28	25.00	18.55	13.70	7.60	2.28	.80
3	60.6	59.8	59.5	57.2	46.94	30.90	14.56	5.44	3.12	1.66	1.20	2.26
4	51.8	52.3	55.7	62.8	66.06	57.51	39.72	21.01	13.19	6.50	2.33	2.41
5	62.2	61.6	59.4	54.5	44.18	31.14	18.26	9.16	5.62	3.00	1.53	2.46
6	5.4	5.3	5.2	4.9	3.65	2.07	1.09	.59	.49	.47	.78	2.10
7	9.2	9.1	9.2	9.1	8.34	6.97	5.15	3.24	2.30	1.41	1.00	2.01
8	38.6	38.0	35.9	32.8	26.20	18.39	11.40	5.59	3.44	1.86	1.09	2.01
9	38.6	37.8	34.7	27.4	16.96	8.62	4.05	1.86	1.26	.88	.90	2.01
10	28.4	28.1	26.3	22.9	15.97	8.98	4.54	2.17	1.49	1.02	1.01	2.25
11	16.1	15.7	14.4	11.6	8.11	4.89	2.75	1.36	.94	.69	.85	2.08
12	14.9	14.6	13.6	11.1	7.38	4.12	2.04	1.04	.77	.62	.93	2.45
13	4.4	4.4	4.2	3.8	3.29	2.73	2.34	1.80	1.55	1.30	1.17	.95
14	3.3	3.2	2.8	2.5	2.11	2.05	2.05	1.69	1.40	1.09	.99	1.08
15	2.6	2.5	2.4	2.3	1.95	1.69	1.48	1.25	1.14	1.06	1.15	1.46
16	68.8	67.9	46.2	16.0	12.09	10.69	9.53	8.61	7.91	6.51	4.08	1.93

BRIGHTNESS RATIO*

28.65 FEET .7 DEGREE DIVERGENT ANGLE (31MAR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	12.9	13.6	14.4	13.6	13.79	13.61	12.84	9.82	7.06	4.51	2.29	1.18
2	39.6	40.5	41.1	39.6	36.17	31.45	26.71	18.13	12.02	7.22	1.98	.57
3	67.2	68.5	69.4	63.7	48.73	31.52	14.44	5.10	2.83	1.45	.66	.81
4	50.9	52.5	57.5	63.9	64.97	55.55	38.79	20.40	12.03	6.42	1.83	3.72
5	65.1	65.7	64.4	56.6	43.71	29.94	17.34	8.00	4.77	2.55	.99	.87
6	5.0	4.8	4.8	4.2	2.88	1.58	.76	.34	.24	.20	.31	.68
7	9.0	9.1	9.1	8.8	7.90	6.29	4.42	2.53	1.74	.94	.51	.75
8	43.8	44.4	42.5	36.6	29.23	20.33	12.15	5.47	3.41	1.66	.82	.80
9	45.8	45.8	41.8	31.1	18.89	9.15	4.24	1.88	1.21	.70	.49	.77
10	32.9	33.3	31.7	27.0	18.60	10.19	4.83	2.22	1.40	.80	.56	.97
11	20.9	20.4	18.3	14.0	9.50	5.62	2.90	1.28	.83	.50	.43	.72
12	19.2	19.3	17.6	13.5	8.42	4.40	2.10	.95	.64	.45	.62	1.35
13	5.0	5.0	4.8	4.2	3.57	3.01	2.50	1.93	1.67	1.41	1.27	1.05
14	3.6	3.5	3.3	2.7	2.32	2.21	2.22	1.79	1.56	1.20	1.09	1.08
15	2.9	3.0	2.8	2.4	2.02	1.72	1.43	1.15	1.05	1.09	1.03	.80
16	83.2	83.9	55.7	16.6	12.75	11.08	9.87	8.57	7.75	6.77	4.32	2.12

Table 14. Data and Analysis – 9 Jan 74/31 Mar 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET .7 DEGREE DIVERGENT ANGLE (9JAN74)
28.65 FEET .7 DEGREE DIVERGENT ANGLE (31MAR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	2.3	-1.5	-3.5	0.0	-.87	.22	-1.01	3.77	10.48	5.32	8.30	24.58
2	-10.4	-13.3	-15.1	-13.1	-10.89	-6.90	-6.40	2.32	13.98	5.26	15.15	40.35
3	-9.8	-12.7	-14.3	-10.2	-3.67	-1.97	.83	6.67	10.25	14.48	81.82	179.01
4	1.8	-.4	-3.1	-1.7	1.68	3.53	2.40	2.99	9.64	1.25	27.32	-35.22
5	-4.3	-6.2	-7.8	-3.7	1.08	4.01	5.31	14.50	17.82	17.65	54.55	182.76
6	8.0	10.4	8.3	16.7	26.74	31.01	43.42	73.53	104.17	135.00	151.61	208.82
7	2.2	0.0	1.1	3.4	5.57	10.81	16.52	28.06	32.18	50.00	96.08	168.00
8	-11.9	-14.4	-15.5	-10.4	-10.37	-9.54	-6.17	2.19	.88	12.05	32.93	151.25
9	-15.7	-17.5	-17.0	-11.9	-10.22	-5.79	-4.48	-1.06	4.13	25.71	83.67	161.04
10	-13.7	-15.6	-17.0	-15.2	-14.14	-11.87	-6.00	-2.25	6.43	27.50	80.36	131.96
11	-23.0	-23.0	-21.3	-17.1	-14.63	-12.99	-5.17	6.25	13.25	33.00	97.67	188.89
12	-22.4	-24.4	-22.7	-17.8	-12.35	-6.36	-2.86	9.47	20.31	37.78	50.00	81.48
13	-12.0	-12.0	-12.5	-9.5	-7.84	-9.30	-6.40	-6.74	-7.19	-7.80	-7.87	-9.52
14	-8.3	-8.6	-15.2	-7.4	-9.05	-7.24	-7.66	-5.59	-10.26	-9.17	-9.17	0.00
15	-10.3	-16.7	-14.3	-4.2	-3.47	-1.74	3.50	8.70	8.57	-2.75	11.65	82.50
16	-17.3	-19.1	-17.1	-3.6	-5.18	-3.52	-3.44	.47	2.06	-3.84	-5.56	-8.96

GRAND MEAN= 12.3 STD DEV= 43.4

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-9.06	8.99	10	-10.93	9.37	20	-11.68	8.46
30	-6.61	8.75	40	-4.23	10.19	50	-1.73	10.77
60	1.40	12.80	70	8.95	19.13	75	14.79	25.93
80	21.65	35.03	85	48.03	46.84	88	96.68	84.34

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	4.01	7.71	2	.08	16.45	3	20.04	56.30
4	.84	13.88	5	22.96	53.15	6	68.14	67.04
7	34.50	50.40	8	10.08	46.54	9	15.91	53.70
10	12.54	46.82	11	18.90	63.82	12	7.52	33.74
13	-9.06	2.13	14	-8.13	3.45	15	5.12	25.97
16	-7.08	7.05						

LESS THAN 2%	10.42%
2-5%	14.58%
5-10%	23.96%
10-15%	18.23%
15-20%	10.42%
GREATER THAN 20%	22.40%

Table 15. Data and Analysis – 6 Jun 73/3 Apr 73

BRIGHTNESS RATIO*

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (6JUNE73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.3	10.8	11.1	10.5	10.20	9.76	9.33	7.56	5.75	3.71	2.11	1.31
2	21.2	21.8	21.6	20.8	19.76	17.94	15.39	13.03	10.82	6.83	2.25	.90
3	34.4	34.9	35.2	35.2	31.58	23.09	11.89	4.76	2.74	1.46	.90	1.28
4	34.0	35.4	38.2	44.2	52.35	50.82	36.06	18.34	11.54	6.04	2.19	1.55
5	36.3	37.3	37.4	36.4	32.21	24.56	15.56	8.00	5.03	2.83	1.37	1.48
6	3.0	3.0	2.9	2.8	2.35	1.58	.86	.46	.35	.34	.58	1.23
7	6.0	6.1	6.1	6.1	5.95	5.32	4.04	2.55	1.33	1.18	.80	1.25
8	20.3	20.5	20.2	19.2	16.76	13.18	8.38	4.39	2.83	1.56	.89	1.27
9	17.2	17.5	17.5	16.2	11.60	6.94	3.52	1.71	1.16	.78	.75	1.29
10	14.5	14.9	14.7	13.6	10.83	6.72	3.63	1.77	1.20	.81	.80	1.38
11	7.2	7.2	7.0	6.3	5.02	3.45	2.04	1.09	.75	.53	.61	1.14
12	6.6	6.7	6.4	5.8	4.29	2.64	1.45	.78	.56	.44	.64	1.33
13	3.5	3.5	3.5	3.3	2.91	2.46	2.00	1.55	1.31	1.10	1.01	.99
14	2.6	2.6	2.5	2.2	1.94	1.88	1.78	1.46	1.19	.94	.82	.70
15	2.0	2.0	1.9	1.8	1.65	1.47	1.26	1.02	.90	.81	.92	.87
16	21.0	21.4	16.7	9.3	8.00	7.48	6.82	6.32	5.96	5.00	3.35	1.72

BRIGHTNESS RATIO*

28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (3APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	9.9	10.2	10.6	9.8	9.47	9.35	8.42	6.79	5.31	3.71	2.15	1.32
2	20.2	20.3	19.1	19.5	18.25	16.62	14.22	12.01	9.53	6.47	2.20	.54
3	32.5	33.3	33.9	33.1	29.34	21.22	11.21	4.78	2.66	1.36	.63	.73
4	32.5	33.9	36.8	42.3	47.63	44.65	36.21	16.02	10.35	5.75	1.95	.91
5	35.2	35.9	35.6	33.2	28.11	21.17	12.20	6.52	4.06	2.26	.93	.80
6	2.5	2.3	2.3	2.1	1.73	1.05	.54	.25	.19	.17	.24	.55
7	5.2	5.2	5.2	5.1	4.75	4.15	3.04	1.93	1.39	.84	.45	.73
8	20.5	21.0	20.5	19.2	16.98	12.55	7.81	4.40	2.85	1.51	.66	.73
9	18.0	18.8	18.3	15.5	10.75	5.77	2.95	1.44	.94	.55	.38	.55
10	16.4	16.6	16.8	14.9	10.93	6.75	3.53	1.65	1.10	.62	.41	.70
11	8.4	8.6	8.2	7.2	8.20	6.79	4.92	3.39	.66	.40	.28	.46
12	7.9	7.9	7.7	6.4	4.58	2.83	1.43	.74	.48	.30	.27	.70
13	3.7	3.8	3.7	3.3	2.83	2.37	2.00	1.52	1.29	1.05	.88	.63
14	2.6	2.6	2.4	2.1	1.81	1.77	1.67	1.33	1.09	.79	.65	.51
15	2.1	2.1	2.0	1.8	1.61	1.37	1.13	.90	.78	.66	.54	.45
16	25.3	25.3	18.8	9.9	8.41	7.71	6.64	6.35	6.04	5.73	4.04	2.51

Table 15. Data and Analysis – 6 Jun 73/3 Apr 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (6JUNE73)
28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (3APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	4.0	5.9	4.7	7.1	7.71	4.39	10.81	11.34	8.29	0.00	-1.86	-.76
2	5.0	7.4	13.1	6.7	8.27	7.94	8.23	8.49	13.54	5.56	2.27	66.67
3	5.8	4.8	3.8	6.3	7.63	8.81	6.07	-.42	3.01	7.35	42.86	75.34
4	4.6	4.4	3.8	4.5	9.91	13.82	-.41	14.48	11.50	5.04	12.31	70.33
5	3.1	3.9	5.1	9.6	14.59	16.01	27.54	22.70	25.37	25.22	47.31	85.00
6	20.0	30.4	26.1	33.3	35.84	50.48	59.26	84.00	84.21	100.00	141.67	123.64
7	15.4	17.3	17.3	19.6	25.26	28.19	32.89	32.12	31.65	40.48	77.78	71.23
8	-1.0	-2.4	-1.5	0.0	-1.30	5.02	7.30	-.23	-.70	3.31	34.85	73.97
9	-4.4	-6.9	-4.4	4.5	7.91	20.28	19.32	18.75	23.40	41.82	97.37	134.55
10	-11.5	-10.2	-12.5	-8.7	-.91	-.44	2.83	7.27	9.09	30.65	95.12	97.14
11	-14.3	-16.3	-14.6	-12.5	-38.78	-49.19	-58.54	-67.85	13.64	32.50	117.86	147.83
12	-16.5	-15.2	-16.9	-9.4	-6.33	-6.71	1.40	5.41	16.67	46.67	137.04	90.00
13	-5.4	-7.9	-5.4	0.0	2.83	3.80	0.00	1.97	1.55	4.76	14.77	57.14
14	0.0	0.0	4.2	4.8	7.18	6.21	6.59	9.77	9.17	18.99	26.15	37.25
15	-4.8	-4.8	-5.0	0.0	2.48	7.30	11.50	13.33	15.38	22.73	70.37	93.33
16	-17.0	-15.4	-11.2	-6.1	-4.88	-2.98	2.71	-.47	-1.32	-12.74	-17.08	-31.47

GRAND MEAN= 17.0 STO DEV= 34.5

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-1.06	10.63	10	-.31	12.51	20	.41	11.83
30	3.74	11.32	40	4.84	15.80	50	7.06	20.28
60	8.59	23.72	70	10.04	29.11	75	16.53	20.30
80	23.27	26.73	85	56.17	50.61	88	74.45	45.67

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	5.14	4.30	2	12.76	17.26	3	14.29	22.18
4	12.86	18.70	5	23.79	23.04	6	65.75	40.56
7	34.10	20.40	8	9.78	22.64	9	29.35	43.54
10	16.47	39.06	11	3.31	67.18	12	18.85	48.67
13	5.68	17.24	14	10.85	11.17	15	18.49	31.26
16	-9.82	9.61						

LESS THAN 2%	11.98%
2-5%	16.67%
5-10%	21.87%
10-15%	10.94%
15-20%	9.37%
GREATER THAN 20%	29.17%

Table 16. Data and Analysis – 6 Jun 73/10 Jan 74

BRIGHTNESS RATIO*

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (6JUNE73)

	INCIDENT ANGLE											
	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.3	10.8	11.1	10.5	10.20	9.76	9.33	7.56	5.75	3.71	2.11	1.31
2	21.2	21.8	21.6	20.8	19.76	17.94	15.39	13.03	10.82	6.83	2.25	.90
3	34.4	34.9	35.2	35.2	31.58	23.09	11.89	4.76	2.74	1.46	.90	1.28
4	34.0	35.4	38.2	44.2	52.35	50.82	36.06	18.34	11.54	6.04	2.19	1.55
5	36.3	37.3	37.4	36.4	32.21	24.56	15.56	8.00	5.09	2.83	1.37	1.48
6	3.0	3.0	2.9	2.8	2.35	1.58	.86	.46	.35	.34	.58	1.23
7	6.0	6.1	6.1	6.1	5.95	5.32	4.04	2.55	1.83	1.18	.80	1.25
8	20.3	20.5	20.2	19.2	16.76	13.18	8.38	4.39	2.83	1.56	.89	1.27
9	17.2	17.5	17.5	16.2	11.60	6.94	3.52	1.71	1.16	.78	.75	1.29
10	14.5	14.9	14.7	13.6	10.83	6.72	3.63	1.77	1.20	.81	.80	1.38
11	7.2	7.2	7.0	6.3	5.02	3.45	2.04	1.09	.75	.53	.61	1.14
12	6.6	6.7	6.4	5.8	4.23	2.64	1.45	.78	.56	.44	.64	1.33
13	3.5	3.5	3.5	3.3	2.91	2.46	2.00	1.55	1.31	1.10	1.01	.99
14	2.6	2.6	2.5	2.2	1.94	1.88	1.78	1.46	1.19	.94	.82	.70
15	2.0	2.0	1.9	1.8	1.65	1.47	1.26	1.02	.90	.81	.92	.87
16	21.0	21.4	16.7	9.3	8.00	7.48	6.82	6.32	5.96	5.00	3.35	1.72

BRIGHTNESS RATIO*

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENCE ANGLE (10JAN74)

	INCIDENT ANGLE											
	-4	10	20	30	40	50	60	70	75	80	85	88
1	9.9	10.2	10.2	9.6	9.19	9.19	8.73	7.08	5.38	3.59	2.06	1.22
2	21.5	21.5	20.9	20.0	18.54	16.55	14.25	11.99	9.93	6.41	2.14	.65
3	34.0	34.2	34.1	34.1	30.82	22.84	12.30	4.98	2.92	1.58	1.02	1.67
4	32.9	33.3	35.5	40.1	45.41	44.86	33.05	17.81	11.59	6.44	2.55	2.09
5	36.1	36.3	35.9	34.4	30.05	23.29	14.84	7.63	4.97	2.84	1.43	1.78
6	2.9	2.9	2.9	2.8	2.36	1.54	.87	.50	.41	.42	.72	1.78
7	6.0	6.0	6.0	6.0	5.79	5.25	4.03	2.58	1.92	1.26	.87	1.55
8	20.2	20.2	19.7	18.5	16.15	12.91	8.31	4.52	3.00	1.72	.97	1.57
9	17.2	17.1	17.1	15.4	11.05	6.66	3.41	1.70	1.19	.85	.79	1.55
10	14.8	14.8	14.7	13.4	10.55	6.62	3.62	1.79	1.26	.88	.86	1.75
11	7.5	7.4	7.1	6.4	5.04	3.53	2.09	1.14	.82	.61	.70	1.57
12	6.9	6.9	6.7	5.9	4.39	2.74	1.53	.85	.66	.55	.77	1.90
13	3.7	3.7	3.6	3.4	2.94	2.50	2.03	1.57	1.32	1.11	.97	.82
14	2.7	2.7	2.5	2.2	1.92	1.89	1.81	1.46	1.19	.93	.80	.85
15	2.1	2.1	2.0	1.9	1.73	1.55	1.34	1.10	.93	.90	.92	1.13
16	23.2	22.7	16.9	9.4	8.16	7.60	6.93	6.43	6.01	5.06	3.33	1.60

Table 16. Data and Analysis – 6 Jun 73/10 Jan 74 (cont'd)

ANALYSIS

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (6JUNE73)
FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENCE ANGLE (10JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	4.0	5.9	8.8	9.4	10.99	6.20	6.87	6.78	6.88	3.34	2.43	7.38
2	-1.4	1.4	3.3	4.0	6.58	8.40	8.00	8.67	8.96	6.55	5.14	38.46
3	1.2	2.0	3.2	3.2	2.47	1.09	-3.33	-4.42	-6.16	-7.59	-11.76	-23.35
4	3.3	6.3	7.6	10.2	15.28	13.29	9.11	2.98	-.43	-6.21	-14.12	-25.84
5	.6	2.8	4.2	5.8	7.19	5.45	4.85	4.85	2.41	-.35	-4.20	-16.85
6	3.4	3.4	0.0	0.0	-.42	2.60	-1.15	-8.00	-14.63	-19.05	-19.44	-30.90
7	0.0	1.7	1.7	1.7	2.76	1.33	.25	-1.16	-4.69	-6.35	-8.05	-19.35
8	.5	1.5	2.5	3.8	3.78	2.09	.84	-2.88	-5.67	-9.30	-8.25	-19.11
9	0.0	2.3	2.3	5.2	4.98	4.20	3.23	.59	-2.52	-8.24	-5.06	-16.77
10	-2.0	.7	0.0	1.5	2.65	1.51	.28	-1.12	-4.76	-7.95	-6.98	-21.14
11	-4.0	-2.7	-1.4	-1.6	-.40	-2.27	-2.39	-4.39	-8.54	-13.11	-12.86	-27.39
12	-4.3	-2.9	-4.5	-1.7	-2.28	-3.65	-5.23	-8.24	-15.15	-20.00	-16.88	-30.00
13	-3.4	-5.4	-2.8	-2.9	-1.02	-1.60	-1.48	-1.27	-.76	-.90	4.12	20.73
14	-3.7	-3.7	0.0	0.0	1.04	-.53	-1.66	0.00	0.00	1.08	2.50	-17.65
15	-4.8	-4.8	-5.0	-5.3	-4.62	-5.16	-5.97	-7.27	-8.16	-10.00	0.00	-23.01
16	-9.5	-5.7	-1.2	-1.1	-1.96	-1.58	-1.59	-1.71	-.83	-1.19	.60	7.50

GRAND MEAN= -1.8 STD DEV= 8.6

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-1.38	3.72	10	.18	3.87	20	1.18	3.86
30	2.02	4.30	40	2.94	5.19	50	1.96	4.75
60	.66	4.55	70	-1.04	5.00	75	-3.38	6.62
80	-6.20	7.44	85	-5.80	7.78	88	-12.33	20.00

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	6.58	2.49	2	8.18	10.05	3	-3.62	7.90
4	1.79	11.99	5	1.39	6.55	6	-7.01	11.35
7	-2.52	6.36	8	-2.52	6.92	9	-.81	6.50
10	-3.11	6.62	11	-6.75	7.81	12	-9.57	8.94
13	.11	6.94	14	-1.89	5.29	15	-7.00	5.58
16	-1.52	3.91						

LESS THAN 2%	29.69%
2-5%	30.21%
5-10%	25.52%
10-15%	4.17%
15-20%	5.73%
GREATER THAN 20%	4.69%

Table 17. Data and Analysis – 10 Jan 74/3 Apr 73

BRIGHTNESS RATIO

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (10JAN74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	9.9	10.2	10.2	9.6	9.19	9.19	8.75	7.08	5.38	3.59	2.06	1.22
2	21.5	21.5	20.9	20.0	18.54	16.55	14.25	11.99	9.93	6.41	2.14	.65
3	34.1	34.2	34.1	34.1	33.82	22.94	12.30	4.98	2.92	1.58	1.02	1.67
4	32.9	33.3	35.5	40.1	45.41	44.86	33.05	17.81	11.59	6.44	2.55	2.09
5	36.1	36.3	35.9	34.4	36.05	23.29	14.84	7.63	4.97	2.84	1.43	1.78
6	2.3	2.9	2.3	2.8	2.36	1.54	.87	.56	.41	.42	.72	1.78
7	6.0	6.0	6.0	6.0	5.79	5.25	4.03	2.58	1.92	1.26	.87	1.55
8	20.2	20.2	19.7	18.5	16.15	12.91	8.31	4.52	3.00	1.72	.97	1.57
9	17.2	17.1	17.1	15.4	11.05	6.66	3.41	1.75	1.19	.85	.79	1.55
10	14.8	14.8	14.7	13.4	10.55	5.62	3.62	1.79	1.26	.88	.86	1.75
11	7.3	7.4	7.1	6.4	5.04	3.53	2.09	1.14	.82	.61	.70	1.57
12	6.9	6.9	6.7	5.9	4.39	2.74	1.53	.85	.66	.55	.77	1.90
13	3.7	3.7	3.6	3.4	2.94	2.50	2.03	1.57	1.32	1.11	.97	.82
14	2.7	2.7	2.5	2.2	1.92	1.89	1.81	1.46	1.19	.93	.80	.85
15	2.1	2.1	2.0	1.9	1.73	1.55	1.34	1.11	.98	.90	.92	1.13
16	23.2	22.7	16.9	9.4	8.16	7.60	6.93	6.43	5.01	5.06	3.33	1.60

28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (3APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	9.3	10.2	10.5	9.8	9.47	9.35	8.42	6.79	5.31	3.71	2.15	1.32
2	20.2	20.3	19.1	19.5	18.25	16.62	14.22	12.01	9.53	6.47	2.20	.54
3	32.3	33.3	33.3	33.1	29.34	21.27	11.21	4.78	2.66	1.36	.63	.73
4	32.5	33.9	36.8	42.3	47.03	44.65	33.21	16.02	10.35	5.75	1.95	.91
5	35.2	35.9	35.6	33.2	28.11	21.17	12.21	6.52	4.06	2.26	.93	.80
6	2.3	2.3	2.3	2.1	1.73	1.05	.56	.25	.19	.17	.24	.55
7	5.2	5.2	5.2	5.1	4.75	4.15	3.04	1.93	1.39	.84	.45	.73
8	20.3	21.1	20.5	19.2	16.98	12.55	7.81	4.41	2.85	1.51	.66	.73
9	18.0	18.6	18.3	15.5	10.75	5.77	2.95	1.44	.94	.55	.38	.55
10	16.4	16.5	16.8	14.9	10.93	6.75	3.53	1.69	1.10	.62	.41	.70
11	8.4	8.6	8.2	7.2	8.20	6.79	4.92	3.39	.66	.40	.28	.46
12	7.3	7.9	7.7	6.4	4.56	2.83	1.43	.74	.48	.30	.27	.70
13	3.7	3.8	3.7	3.3	2.83	2.37	2.01	1.52	1.29	1.05	.88	.63
14	2.6	2.6	2.4	2.1	1.81	1.77	1.67	1.33	1.19	.79	.65	.51
15	2.1	2.1	2.0	1.8	1.61	1.37	1.13	.90	.78	.66	.54	.45
16	25.3	25.3	18.8	9.9	8.41	7.71	6.64	6.35	5.04	5.73	4.04	2.51

Table 17. Data and Analysis – 10 Jan 74/3 Apr 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (10JAN74)
28.65 FEET 1-1/3 DEGREE DIVERGENT ANGLE (3APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	0.0	0.0	-3.8	-2.[illegible]	-2.96	-1.71	3.68	4.27	1.32	-3.23	-4.19	-7.58
2	6.4	5.9	9.4	2.6	1.59	-.42	.21	-.17	4.20	-.93	-2.73	20.37
3	4.6	2.7	.6	3.0	5.04	7.63	9.72	4.18	9.77	16.18	61.90	128.77
4	1.2	-1.8	-3.5	-5.2	-4.56	.47	-8.73	11.17	11.98	12.00	30.77	129.67
5	2.6	1.1	.8	3.6	6.90	10.01	21.64	17.02	22.41	25.66	53.76	122.50
6	16.0	20.1	26.1	33.3	36.42	46.67	61.11	100.00	115.79	147.06	200.00	223.64
7	15.4	15.4	15.4	17.6	21.89	26.51	32.57	33.68	38.13	50.00	93.33	112.33
8	-1.5	-3.8	-3.9	-3.6	-4.89	2.87	6.40	2.73	5.26	13.91	46.97	115.07
9	-4.4	-9.0	-6.6	-.6	2.79	15.42	15.59	18.06	26.60	54.55	137.89	181.82
10	-9.8	-10.8	-12.5	-10.1	-3.48	-1.93	2.55	8.48	14.55	41.94	109.76	150.00
11	-10.7	-14.0	-13.4	-11.1	-38.54	-49.01	-57.52	-66.37	24.24	52.50	150.00	241.30
12	-12.7	-12.7	-13.0	-7.8	-4.15	-3.19	6.99	14.86	37.50	83.33	185.19	171.43
13	0.0	-2.6	-2.7	3.0	3.89	5.49	1.50	3.29	2.33	5.71	10.23	30.16
14	3.8	3.8	4.2	4.8	6.08	5.78	8.38	9.77	9.17	17.72	23.08	66.67
15	0.0	0.0	0.0	5.6	7.45	13.14	18.58	22.22	25.64	36.36	70.37	151.11
16	-8.3	-10.3	-10.1	-5.1	-2.97	-1.43	4.37	1.26	-.50	-11.69	-17.57	-36.25

GRAND MEAN= 22.1 STD DEV= 48.7

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	.17	8.32	10	-.62	10.50	20	-.81	10.69
30	1.75	11.02	40	1.90	15.31	50	4.89	19.10
60	7.94	23.84	70	11.53	31.72	75	21.77	27.96
80	33.82	39.44	85	69.92	56.72	88	112.56	79.46

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	-1.35	3.40	2	3.87	6.29	3	21.18	37.69
4	14.45	37.91	5	24.00	34.47	6	86.02	71.50
7	39.35	31.75	8	14.62	34.68	9	33.50	57.11
10	23.23	52.75	11	17.37	91.74	12	37.16	71.55
13	5.02	8.69	14	15.69	17.70	15	29.20	43.31
16	-8.21	10.81						

LESS THAN 2%	13.54%
2-5%	21.87%
5-10%	15.62%
10-15%	11.46%
15-20%	6.77%
GREATER THAN 20%	30.73%

Table 18. Data and Analysis – 1 Jun 73/15 Apr 73

BRIGHTNESS RATIO*

FOLDED 28.65 FEET 2 DEGREE DIVERGENT ANGLE (1JUNE73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	7.4	7.6	7.8	7.5	7.30	7.41	7.15	5.83	4.90	3.65	2.72	1.84
2	14.6	14.6	14.5	14.9	15.00	14.83	12.87	9.09	7.72	5.79	2.67	.69
3	20.6	20.6	20.5	21.3	20.56	16.15	9.55	4.03	2.39	1.18	.46	.24
4	21.1	21.7	23.0	26.3	32.55	37.51	31.46	17.42	11.18	5.76	2.26	.65
5	22.0	22.2	22.5	22.9	21.40	18.00	12.92	7.05	4.65	2.61	1.10	.39
6	1.8	1.8	1.8	1.8	1.68	1.24	.72	.36	.24	.14	.08	.12
7	4.3	4.3	4.3	4.4	4.41	4.09	3.65	2.48	1.79	1.07	.45	.22
8	11.1	11.3	11.2	11.2	10.36	9.13	6.74	3.80	2.58	1.45	.54	.23
9	8.1	8.2	8.5	8.6	7.14	4.77	2.72	1.36	.92	.53	.26	.16
10	7.3	7.4	7.8	7.8	6.83	4.99	2.98	1.53	1.03	.58	.27	.17
11	3.7	3.7	3.7	3.5	3.03	2.24	1.50	.80	.55	.33	.17	.15
12	2.8	2.9	3.1	3.0	2.50	1.67	1.01	.54	.36	.22	.10	.12
13	3.3	3.3	3.3	3.2	2.82	2.44	2.02	1.54	1.35	1.14	1.14	1.27
14	2.5	2.5	2.3	2.0	1.72	1.54	1.42	1.20	1.12	1.03	1.11	1.27
15	1.7	1.7	1.7	1.7	1.54	1.43	1.29	1.04	.92	.83	.89	1.02
16	9.4	9.1	7.9	6.3	5.87	5.87	5.77	5.49	5.41	4.98	4.36	3.19

BRIGHTNESS RATIO*

28.65 FEET 2 DEGREE DIVERGENCE ANGLE (15APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	7.0	7.4	7.6	7.3	7.06	7.00	6.69	5.68	4.79	3.57	2.50	2.42
2	17.2	17.5	17.3	17.3	17.06	15.88	13.16	9.57	8.62	6.58	2.93	1.19
3	22.9	23.4	23.6	24.5	23.99	19.36	11.45	5.25	3.28	1.71	.74	.65
4	23.7	24.6	26.0	29.2	34.28	36.66	29.62	17.43	11.52	6.45	2.47	1.67
5	24.2	24.7	24.7	24.4	22.29	18.14	12.06	6.71	4.68	2.65	1.13	.92
6	2.0	1.9	1.8	1.8	1.62	1.13	.64	.32	.22	.14	.13	.44
7	4.3	4.2	4.2	4.2	4.16	3.80	3.11	2.13	1.56	.96	.43	.51
8	12.5	12.6	12.5	12.3	11.23	9.27	6.67	4.05	3.57	1.63	.67	.64
9	9.4	9.5	9.9	9.7	7.49	4.79	2.61	1.35	.96	.60	.35	.57
10	8.8	8.7	9.2	9.0	7.44	5.13	2.92	1.51	.97	.62	.35	.62
11	4.5	4.6	4.6	4.4	3.80	2.79	1.90	1.07	.82	.53	.33	.48
12	4.0	4.0	4.0	3.7	3.10	2.03	1.14	.61	.45	.29	.27	.81
13	3.2	3.3	3.3	3.1	2.73	2.29	1.84	1.47	1.30	1.10	.97	1.04
14	2.4	2.4	2.2	2.1	1.85	1.77	1.66	1.35	1.17	.93	.85	1.19
15	1.8	1.8	1.8	1.6	1.46	1.30	1.10	.89	.77	.71	.69	.84
16	10.0	9.9	8.4	6.4	6.08	5.90	5.67	5.63	5.66	5.16	4.31	4.00

Table 18. Data and Analysis – 1 Jun 73/15 Apr 73 (cont'd)

ANALYSIS

FOLDED 28.65 FEET 2 DEGREE DIVERGENT ANGLE (1JUNE73)
28.65 FEET 2 DEGREE DIVERGENCE ANGLE (15APR73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	5.7	2.7	2.6	2.7	3.40	5.86	6.88	2.64	2.30	2.24	8.80	-23.97
2	-15.1	-16.6	-16.2	-13.9	-12.08	-6.61	-2.20	-5.02	-10.44	-12.01	-8.87	-42.02
3	-10.0	-12.0	-13.1	-13.1	-14.30	-16.58	-16.59	-23.24	-27.13	-30.99	-37.84	-63.08
4	-11.0	-11.8	-11.5	-9.9	-5.05	2.32	6.21	-.06	-2.35	-10.70	-8.50	-61.08
5	-9.1	-10.1	-8.9	-6.1	-3.99	-.77	7.13	5.07	-.54	-1.51	-2.65	-57.61
6	-10.0	-5.3	0.0	0.0	3.70	9.73	12.50	12.50	9.09	0.00	-38.46	-72.73
7	0.0	2.4	2.4	4.8	6.01	7.63	17.36	16.43	14.74	11.46	4.65	-56.86
8	-11.2	-10.3	-10.4	-8.9	-7.75	-1.51	1.05	-6.17	-27.73	-11.04	-19.40	-64.06
9	-13.8	-13.7	-14.1	-11.3	-4.67	-.42	4.21	.74	-4.17	-11.67	-25.71	-71.93
10	-17.0	-14.9	-15.2	-13.3	-8.20	-2.73	2.05	1.32	6.19	-6.45	-22.86	-72.58
11	-17.8	-19.6	-19.6	-20.5	-20.26	-19.71	-21.05	-25.23	-32.93	-37.74	-48.48	-68.75
12	-30.0	-27.5	-22.5	-18.9	-19.35	-17.73	-11.40	-11.48	-20.00	-24.14	-62.96	-85.19
13	3.1	0.0	0.0	3.2	3.30	6.55	9.78	4.76	3.35	3.64	17.53	22.12
14	4.2	4.2	4.5	-4.8	-7.03	-12.99	-14.46	-11.11	-4.27	10.75	30.59	6.72
15	-5.6	-5.6	-5.6	6.3	5.48	10.00	17.27	16.85	19.48	16.90	28.99	21.43
16	-6.0	-8.1	-6.0	-1.6	-3.45	-.51	1.76	-2.49	-4.42	-3.49	1.16	-20.25

GRAND MEAN= -9.0 STD DEV= 19.4

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	-8.98	9.28	10	-9.13	8.70	20	-8.35	8.41
30	-6.58	8.46	40	-5.27	8.35	50	-2.34	9.83
60	1.28	11.69	70	-1.53	12.20	75	-4.94	15.30
80	-6.55	15.07	85	-11.50	27.09	88	-44.36	34.96

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	1.83	8.40	2	-13.42	10.07	3	-23.16	15.23
4	-10.34	17.07	5	-7.44	16.68	6	-6.58	25.01
7	2.58	19.60	8	-14.79	17.24	9	-13.88	20.05
10	-13.65	20.53	11	-29.29	15.57	12	-29.26	22.15
13	6.49	6.82	14	.53	12.58	15	10.50	11.62
16	-4.44	5.78						

LESS THAN 2%	9.90%
2-5%	19.27%
5-10%	20.31%
10-15%	19.27%
15-20%	11.98%
GREATER THAN 20%	19.27%

Table 19. Data and Analysis – 6 Feb 74/6 May 73

BRIGHTNESS RATIO*

FOLDED 50 FEET .5 DEGREE DIVERGENT ANGLE (6FEB74)

	INCIDENT ANGLE											
	-4	10	20	30	40	50	60	70	75	80	85	88
1	16.7	17.3	17.5	16.4	16.83	16.78	15.46	11.73	8.43	4.91	2.36	1.56
2	54.3	53.8	51.0	47.6	42.73	36.86	28.98	19.21	13.00	6.67	2.15	2.78
3	85.3	85.6	82.6	73.7	56.59	33.78	14.55	5.41	3.24	2.21	2.67	8.66
4	58.0	59.9	65.1	72.6	75.38	64.97	44.77	22.00	13.29	6.82	3.88	9.25
5	79.3	79.5	75.2	65.4	51.61	34.67	20.10	9.51	5.87	3.67	3.46	9.98
6	7.5	7.5	7.3	6.5	4.56	2.61	1.42	.94	.97	1.30	2.57	8.89
7	13.1	13.1	12.9	12.4	11.12	9.03	6.59	3.91	2.85	2.21	2.83	9.25
8	54.2	53.3	48.9	41.0	31.54	21.22	12.30	5.58	3.49	2.40	2.87	9.13
9	57.3	55.9	47.5	33.8	19.79	9.16	4.41	2.13	1.68	1.66	2.80	9.37
10	34.7	34.4	31.8	26.0	17.73	9.44	4.49	2.33	1.69	1.69	2.81	9.74
11	21.9	21.4	18.1	13.5	8.97	5.09	2.88	1.51	1.26	1.35	2.44	8.66
12	21.7	20.7	17.8	13.1	7.74	4.20	2.19	1.26	1.15	1.39	2.74	9.98
13	4.8	4.7	4.4	4.0	3.32	2.82	2.45	1.90	1.60	1.37	1.24	1.29
14	3.5	3.4	3.0	2.5	2.12	2.12	2.15	1.79	1.47	1.20	1.11	1.68
15	2.8	2.7	2.5	2.3	2.01	1.78	1.57	1.40	1.33	1.39	1.75	3.70
16	114.5	111.6	68.2	18.9	14.39	12.81	11.49	10.18	9.23	7.73	4.62	2.53

BRIGHTNESS RATIO*

50 FEET .5 DEGREE DIVERGENT ANGLE (6MAY73)

	INCIDENT ANGLE											
	-4	10	20	30	40	50	60	70	75	80	85	88
1	14.4	15.4	16.4	15.9	16.23	16.11	14.94	11.21	8.34	4.86	2.34	1.34
2	46.9	48.3	49.0	46.4	41.52	37.56	29.48	20.04	13.51	7.23	1.97	1.15
3	75.2	78.2	77.9	70.0	80.68	66.04	41.32	20.74	6.46	4.24	2.85	1.53
4	50.3	53.2	59.5	67.7	69.57	60.44	40.56	20.17	12.06	5.93	1.97	1.77
5	68.5	69.8	69.3	61.2	48.43	33.51	19.57	9.26	5.65	2.85	1.45	1.99
6	6.4	6.4	6.5	6.1	4.26	2.42	1.16	.55	.41	.36	.59	1.50
7	10.8	11.2	11.6	11.2	9.85	8.01	5.69	3.26	2.12	1.25	.93	1.50
8	43.8	45.0	43.0	36.6	27.74	19.12	10.55	4.91	2.96	1.49	.89	1.50
9	46.0	45.7	41.0	29.0	16.63	8.27	3.81	1.66	1.10	.70	.70	1.44
10	30.0	30.4	28.9	24.2	16.52	8.81	4.22	1.88	1.25	.79	.79	1.77
11	19.2	19.0	16.9	12.9	8.54	4.89	2.53	1.14	.78	.55	.64	1.47
12	18.1	18.2	16.5	12.3	7.50	3.95	1.84	.84	.59	.46	.70	1.77
13	4.5	4.5	4.3	3.9	3.20	2.75	2.36	1.90	1.63	1.39	1.27	-1.12
14	3.3	3.2	2.9	2.5	2.12	2.17	2.17	1.84	1.52	1.21	1.30	1.09
15	2.6	2.6	2.5	2.2	1.93	1.71	1.52	1.24	1.11	1.03	1.07	1.18
16	100.6	101.8	65.7	18.3	14.04	12.60	11.33	10.35	9.53	7.89	5.05	2.63

Table 19. Data and Analysis – 6 Feb 74/6 May 73 (cont'd)

ANALYSIS

FOLDED 50 FEET .5 DEGREE DIVERGENT ANGLE (6FEB74)
50 FEET .5 DEGREE DIVERGENT ANGLE (6MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	16.0	12.3	6.7	3.1	3.70	4.16	3.48	4.64	1.08	1.03	.85	16.42
2	15.8	11.4	4.1	2.6	2.91	-1.86	-1.70	-4.14	-3.77	-7.75	9.14	141.74
3	13.4	9.5	6.0	5.3	-29.86	-48.85	-64.79	-73.92	-49.85	-47.88	-6.32	466.01
4	15.3	12.6	9.4	7.2	8.35	7.50	10.38	9.07	10.20	15.01	96.95	422.60
5	15.8	13.9	8.5	6.9	6.57	3.46	2.71	2.70	3.89	28.77	138.62	401.51
6	17.2	17.2	12.3	6.6	7.04	7.85	22.41	70.91	136.59	261.11	335.59	492.67
7	21.3	17.0	11.2	10.7	12.89	12.73	15.82	19.94	34.43	76.80	204.30	516.67
8	23.7	18.4	13.7	12.0	13.70	10.98	16.59	13.65	17.91	61.07	222.47	508.67
9	25.7	22.3	15.9	16.6	19.00	10.76	15.75	28.31	52.73	137.14	300.00	550.69
10	15.7	13.2	10.0	7.4	7.32	7.15	6.40	23.94	34.13	113.92	255.70	450.28
11	14.1	12.6	7.1	4.7	5.04	4.09	13.83	32.46	61.54	145.45	281.25	489.12
12	19.9	13.7	7.9	6.5	3.20	6.33	19.02	50.00	94.92	202.17	291.43	463.84
13	6.7	4.4	2.3	2.6	3.75	2.55	3.81	0.00	-1.84	-1.44	-2.36	*15.18
14	6.1	6.3	3.4	0.0	0.00	-2.30	-.92	-2.72	-3.29	-.83	-14.62	54.13
15	7.7	3.8	0.0	4.5	4.15	4.09	3.29	12.90	19.82	34.95	63.55	213.56
16	13.8	9.6	3.8	3.3	2.49	1.67	1.41	-1.64	-3.15	-2.03	-8.51	-3.80

GRAND MEAN= 49.9 STD DEV= 119.6

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	15.50	5.56	10	12.39	5.00	20	7.65	4.35
30	6.25	4.11	40	4.39	10.36	50	1.89	14.18
60	4.22	19.90	70	11.63	30.71	75	25.33	44.48
80	63.60	86.24	85	135.50	132.30	88	310.56	239.14

	MEAN	DEV		MEAN	DEV		MEAN	DSV
1	6.13	5.63	2	14.03	40.81	3	14.90	145.41
4	52.05	119.34	5	52.77	116.18	6	115.62	161.86
7	79.48	148.30	8	77.75	148.25	9	99.56	164.90
10	78.76	137.88	11	89.27	150.57	12	98.24	147.01
13	-16.23	62.71	14	3.77	16.75	15	31.03	60.31
16	1.41	6.03						

LESS THAN 2%	8.33%
2-5%	20.31%
5-10%	17.19%
10-15%	14.06%
15-20%	11.46%
GREATER THAN 20%	28.65%

Table 20. Data and Analysis – 10 Feb 74/5 May 73

BRIGHTNESS RATIO*

FOLDED 50 FEET 1-1/3. DEGREE DIVERGENT ANGLE (10FEB74)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.9	11.2	11.3	10.7	10.60	10.55	10.21	8.58	6.73	4.60	2.59	1.50
2	21.8	22.0	21.4	20.7	19.48	17.53	15.43	13.55	11.83	7.79	2.69	.62
3	34.7	34.7	34.5	33.8	28.63	19.15	10.30	4.01	2.45	1.27	.49	.20
4	29.9	30.3	33.1	39.4	47.96	48.70	37.02	19.20	12.37	6.71	2.22	.58
5	38.4	38.4	37.4	36.5	31.87	24.19	15.93	7.84	5.14	2.84	.99	.33
6	3.6	3.4	3.4	3.3	2.61	1.72	.97	.45	.30	.17	.09	.08
7	6.5	6.6	6.6	6.7	6.37	5.71	4.58	2.91	2.08	1.24	.43	.16
8	20.3	20.6	20.2	19.1	16.53	12.74	8.82	4.88	3.24	1.69	.55	.18
9	16.7	16.4	16.5	14.9	10.61	6.14	3.24	1.53	1.01	.58	.26	.12
10	14.3	14.5	14.2	12.9	9.90	6.30	3.56	1.62	1.05	.60	.25	.12
11	7.2	6.9	6.7	6.0	4.47	2.97	1.80	.89	.58	.33	.14	.09
12	6.3	6.2	6.0	5.2	3.75	2.27	1.24	.65	.44	.25	.11	.09
13	3.8	3.8	3.7	3.5	3.05	2.66	2.18	1.64	1.43	1.25	1.15	1.07
14	2.9	2.8	2.6	2.2	1.77	1.62	1.58	1.41	1.27	1.19	1.26	1.41
15	1.9	2.0	1.9	1.9	1.77	1.62	1.52	1.28	1.23	1.14	1.07	.89
16	23.6	23.8	17.3	9.8	8.63	8.12	7.68	7.18	6.95	6.17	4.51	2.85

BRIGHTNESS RATIO*

50 FEET 1-1/3 DEGREE DIVERGENT ANGLE (5MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	10.5	10.6	10.9	10.3	10.07	9.58	9.02	7.25	5.89	6.12	4.97	4.35
2	21.4	21.0	21.0	20.1	18.93	16.80	15.03	13.08	11.34	11.08	4.90	1.52
3	33.5	33.5	33.3	32.3	27.65	18.18	8.59	3.35	1.90	1.44	.67	.26
4	30.0	30.5	33.6	39.7	49.06	48.94	35.74	18.53	11.97	9.39	3.69	1.19
5	36.0	35.9	36.4	35.2	31.18	24.27	16.05	8.16	5.36	4.25	1.86	.80
6	3.4	3.2	3.2	3.1	2.49	1.51	.80	.40	.25	.19	.09	.05
7	6.4	6.4	6.4	6.5	6.40	5.55	4.36	2.83	2.06	1.78	.77	.31
8	18.4	18.9	18.3	18.0	16.00	12.74	8.46	4.75	3.18	2.35	.91	.34
9	15.4	15.3	15.0	13.9	10.07	5.88	2.90	1.51	.97	.82	.42	.18
10	13.4	13.4	13.6	12.1	10.07	6.08	3.43	1.65	1.07	.84	.40	.16
11	6.5	6.3	6.1	5.2	4.12	2.57	1.50	.82	.56	.46	.23	.12
12	6.2	6.1	6.0	5.3	3.88	2.26	1.19	.58	.38	.29	.11	.04
13	4.3	4.4	4.3	4.0	3.56	2.97	2.37	1.83	1.55	1.74	1.81	2.54
14	2.9	2.8	2.5	2.2	1.83	1.74	1.77	1.50	1.25	1.49	1.73	3.09
15	2.2	2.1	2.1	2.0	1.77	1.50	1.40	1.14	1.04	1.41	1.84	2.43
16	22.5	22.8	17.0	10.1	8.71	8.05	7.69	7.23	6.90	3.28	1.63	2.40

Table 20. Data and Analysis – 10 Feb 74/5 May 73 (cont'd)

ANALYSIS

FOLDED 50 FEET 1-1/3 DEGREE DIVERGENT ANGLE (10FEB74)
50 FEET 1-1/3 DEGREE DIVERGENT ANGLE (5MAY73)

INCIDENT ANGLE

	-4	10	20	30	40	50	60	70	75	80	85	88
1	3.8	5.7	3.7	3.9	5.26	10.13	13.19	18.34	14.26	-24.84	-47.89	-65.52
2	1.9	4.8	1.9	3.0	2.91	4.35	2.66	3.59	4.32	-29.69	-45.10	-59.21
3	3.6	3.6	3.6	4.6	3.54	5.34	19.91	19.70	28.95	-11.81	-26.87	-23.08
4	-.3	-.7	-1.5	-.8	-2.24	-.49	3.58	3.62	3.34	-28.54	-39.84	-51.26
5	6.7	7.0	2.7	3.7	2.21	-.33	-.75	-3.92	-4.10	-33.18	-46.77	-58.75
6	5.9	6.3	6.3	6.5	4.82	13.91	21.25	12.50	20.00	-10.53	0.00	60.00
7	1.5	3.1	3.1	3.1	-.47	2.88	5.05	2.83	.97	-30.34	-44.16	-48.39
8	10.3	9.0	10.4	6.1	3.31	0.00	4.26	2.74	1.89	-28.09	-39.56	-47.06
9	8.4	7.2	10.0	7.2	5.36	4.42	11.72	1.32	4.12	-29.27	-38.10	-33.33
10	6.7	8.2	4.4	6.6	-1.69	3.62	3.79	-1.82	-1.87	-28.57	-37.50	-25.00
11	10.8	9.5	9.8	15.4	8.50	15.56	20.00	8.54	5.45	-28.26	-39.13	-25.00
12	1.6	1.6	0.0	-1.9	-3.35	.44	4.20	12.07	15.79	-13.79	0.00	125.00
13	-11.6	-13.6	-14.0	-12.5	-14.33	-10.44	-8.02	-10.38	-7.74	-28.16	-36.46	-57.87
14	0.0	0.0	4.0	0.0	-3.28	-6.90	-10.73	-6.00	1.60	-20.13	-27.17	-54.37
15	-13.6	-4.8	-9.5	-5.0	0.00	8.00	8.57	12.28	18.27	-19.15	-41.85	-63.37
16	4.4	4.4	1.8	-3.0	-.92	.87	-.13	-.69	.72	88.11	176.69	18.75

GRAND MEAN= -2.7 STD DEV= 26.0

	MEAN	DEV		MEAN	DEV		MEAN	DEV
-4	2.50	6.80	10	3.20	5.90	20	2.30	6.50
30	2.31	6.27	40	.60	5.29	50	3.21	6.75
60	6.16	9.31	70	4.67	8.59	75	6.62	9.96
80	-17.26	28.98	85	-20.86	54.65	88	-25.53	52.15

	MEAN	DEV		MEAN	DEV		MEAN	DEV
1	-5.00	26.67	2	-8.72	22.59	3	2.59	16.62
4	-9.59	19.00	5	-10.46	22.52	6	12.23	17.31
7	-8.39	20.09	8	-5.56	20.38	9	-3.41	18.49
10	-5.26	15.75	11	.93	19.78	12	11.81	36.40
13	-18.76	14.98	14	-10.25	16.70	15	-9.18	23.49
16	24.25	54.21						

LESS THAN 2%	18.75%
2-5%	24.48%
5-10%	16.67%
10-15%	11.98%
15-20%	5.21%
GREATER THAN 20%	22.92%

Table 21. Compilation of Analysis Data

No. of Samples	Set No.	Type of Test and Test Distance	Divergent Angle (degrees)	Test Dates	Percentage (a) Mean	(b) St. Dev	(c) ≤2%	(d) ≤10%	(e) ≤20%
16	1	F/15*	1-1/3	26 May 73/17 Apr 73	-3.1	11.7	21.35	79.17	91.15
16	2	F/15	2	17 Jan 74/18 Apr 73	1.9	12.1	19.27	80.73	94.27
16	3	F/F15	2	Apr 73/17 Jan 74	-1.0	14.4	17.19	75.00	95.31
16	4	F/15	2	Apr 73/18 Apr 73	0	13.9	21.35	78.12	91.15
16	5	F/15	5	19 Feb 74/2 May 73	23.4	78.6	7.29	50.0	72.92
15	6	F/28.65	0.7	4 Dec 73/31 Mar 73	14.5	47.1	13.89	49.45	77.78
15	7	F/F28.65	0.7	4 Dec 73/9 Jan 74	1.2	6.0	41.11	91.66	97.78
16	8	F/28.65	0.7	9 Jan 74/31 Mar 73	12.3	43.4	10.42	48.95	77.60
15	9	F/28.65	0.7	9 Jan 73/31 Mar 73	13.0	44.6	8.33	46.66	72.77
16	10	F/28.65	1-1/3	6 Jun 73/3 Apr 73	17.0	34.5	11.98	50.52	70.83
16	11	F/F28.65	1-1/3	6 Jun 73/10 Jan 74	-1.8	8.6	29.69	85.41	95.31
16	12	F/28.65	1-1/3	10 Jan 74/3 Apr 73	22.1	48.7	13.54	51.13	69.27
16	13	F/28.65	2	1 Jun 73/15 Apr 73	-9.0	19.4	9.90	49.48	80.73
16	14	F/50	0.5	6 Feb 74/6 May 73	49.9	119.6	8.33	45.83	71.35
16	14a**	F/50	0.5	6 Feb 74/6 May 73	10.2	8.82		57.03	89.06
16	14b***	F/50	0.5	6 Feb 74/6 May 73	15.3	23.42		51.88	80.63
16	15	F/50	1-1/3	10 Feb 74/5 May 73	-2.7	26.0	18.75	48.43	77.08

* F/ is folded relative to non-folded and F/F is folded relative to folded.
** Special analysis including only -4° through 70° incident angles, see Table 22.
*** Special analysis including only -4° through 80° incident angles, see Table 22.

Table 22. Special Analysis of Set 14 of Table 21

Set Number From Table 21

Sample No.	14 -4° thru 88° Incident Angles		14a -4° thru 70° Incident Angles		14b -4° thru 88° Incident Angles	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1	3.04	7.90	6.76	4.79	5.62	4.86
2	14.03	40.81	3.64	6.86	1.76	7.29
3	14.90	145.41	11.78	41.68	-28.10	33.60
4	52.05	119.34	9.98	2.75	10.50	2.90
5	52.77	116.18	7.57	4.99	9.32	8.21
6	115.62	161.86	20.19	21.27	55.92	82.99
7	79.48	148.30	15.20	3.98	23.28	20.06
8	77.75	148.25	15.34	4.13	20.17	14.85
9	99.56	164.90	19.29	5.80	34.42	37.94
10	78.76	137.88	11.39	6.06	23.92	32.86
11	89.27	150.57	11.74	9.37	30.09	44.22
12	98.24	147.01	15.82	15.11	42.36	62.84
13	-16.23	62.71	3.26	1.93	2.28	2.68
14	3.77	16.75	1.23	3.58	.57	3.50
15	31.03	60.31	5.05	3.80	9.52	10.61
16	1.41	6.03	4.30	4.98	2.92	5.27

IV. DISCUSSION

10. Analysis of Data. Analysis of the data follows:

a. The data indicate that:

(1) 82.7 percent of the analyzed sample pairs of test data agreed to within 20 percent.

(2) 62.8 percent agreed to within 10 percent.

b. The system setup tolerances appeared to be too great, especially for the greater angles-of-incidence measurements.

c. The method is feasible; of 1140 compared sample pairs of data, only an average of 5.84 percent did not agree to within 20 percent of each other. In one set of 180 pairs of data, only 4 pairs exceeded 20 percent.

11. Analysis of Systems. Analysis of the systems follows:

a. The single-folded beam system was tedious and time consuming to set up and the double-folded system was even more so.

b. The three axes of each component had to be correct in order for the light beam to be reflected onto the samples at the same time for the receptor to view the sample. At times the setup required approximately 8 hours of adjusting, aligning, checking, and realigning before it was determined to be acceptable. Test personnel, working in the darkened room and moving about while performing the task, tended to knock the test setup components out of alignment. Realignment of the test setup was necessary. Neither the long setup times nor realignments had been predicted. To use the folded-beam method effectively for measuring the retroreflectivity of samples would necessitate a permanent system to control tolerances. The nonpermanent test setup was not determined practical until after the analysis of the data.

12. Specification Revision. A discussion of specification revisions necessary follows:

a. Interim Federal Specification TT-C-001060, "Coating Compound, Reflective," and Federal Specification, "Paint; Traffic, Premixed Reflectorized," require a test distance of not less than ten times the greatest dimension of the sample. These specifications can be revised to use a folded-beam method.

b. Federal Specification L-S-300, "Sheeting and Tape, Reflective: Non-exposed Lens, Adhesive Backing," requires a test distance of 50 feet; this specification can be revised to accept a new test method for measuring the retroreflectance.

c. Military Specification MIL-S-2580, "Signboards, Blank (for Temporary Outdoor Signs)," requires a test distance of 50 feet; this could be revised to use a new method.

IV. CONCLUSIONS

13. Conclusions. It is concluded that:

a. A folded-beam method for measuring the retroreflectance property of samples is acceptable, except that the test setup tolerances must be controlled tightly.

b. To control the error tolerances adequately would necessitate permanent installation of the test equipment or permanent fixtures for attaching the test equipment.

c. A permanent installation of the test equipment would require design, fabrication, and installation which should be weighed against the future work load.

d. The sample holder design must be such that the settings would be more accurate and reproducible to result in obtaining good data.

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